C&T SOLUTION INC.

CT-MHW0X

Intel® 4th Generation Core™ Processor i7/i5/i3/Pentium/Celeron

Industrial Micro-ATX Motherboard

User's Manual

Version 1.1

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I. Preface

1.1 Disclaimer

All specifications and information in this User's Manual are believed to be accurate and up to date. C&T Solution Inc. does not guarantee that the contents herein are complete, true, accurate or non-misleading. The information in this document is subject to change without notice and does not represent a commitment on the part of C&T Solution Inc.

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II. Introduction

2.1 Product Description

The CT-MHW0X is a single board computer in the Micro-ATX form factor. Its LGA1150 socket is for Intel® 4th Generation Core i7/i5/i3/Celeron processor, which is with the new 22 nm process technology. The four 240-pin DIMM sockets are for dual channel DDR3/DDR3L 1333/1600MHz memory with maximum capacity up to 32GB. The HD graphic controller integrated within the processor works with the Intel® Q87/H81 PCH to support three independent displays. The Intel® Q87/H81 PCH implements Flexible I/O, a technology to allow high speed signals to be configured as PCIe, USB3.0, or SATA signals. Besides, the CT-MHW0X provides Gigabit Ethernet, USB2.0, COM, GPIO, PCI Expressx16, and mini PCI-Express expansion for variety industrial applications.

2.2 Specifications

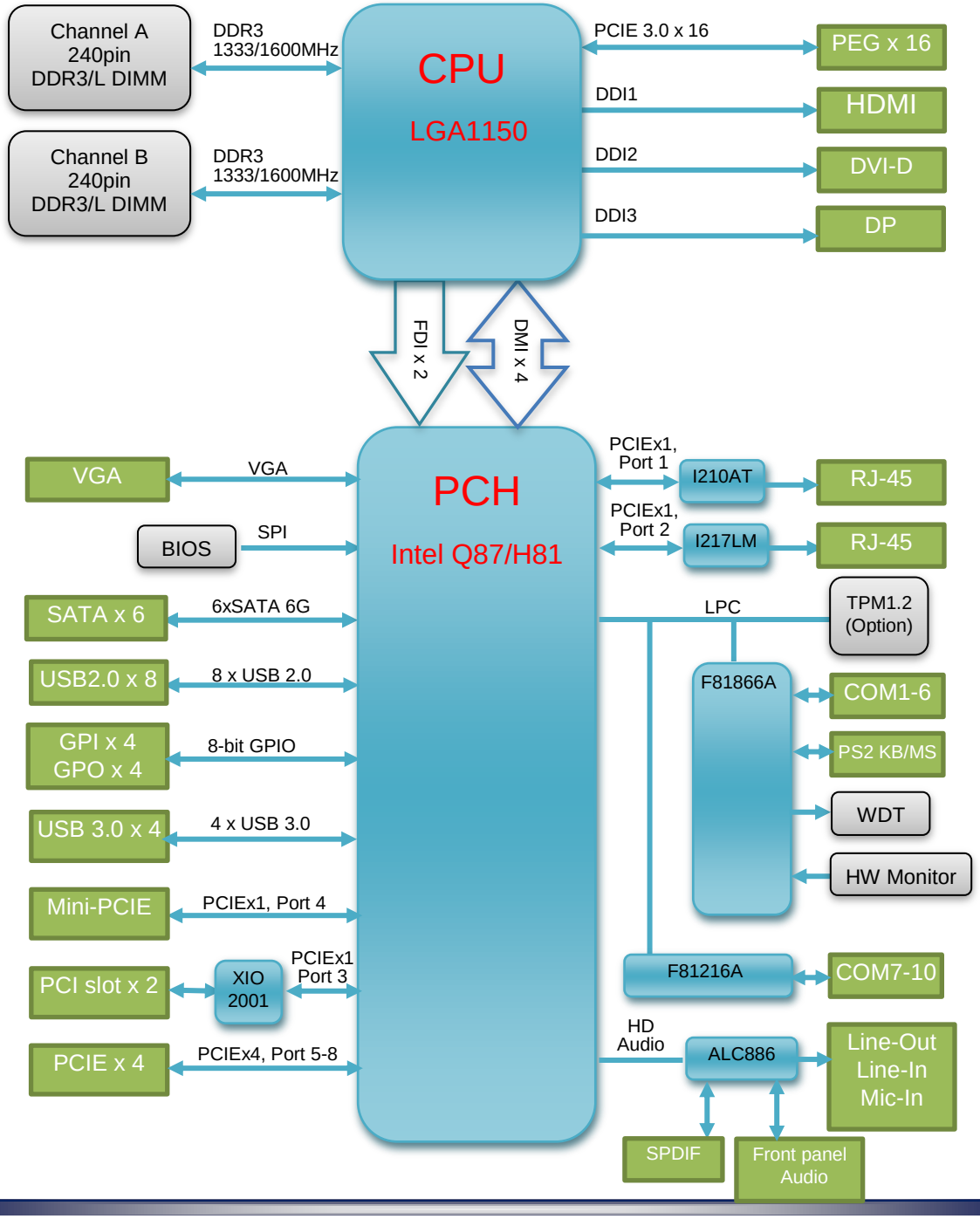
- **CPU**
  - Intel® 4th Generation Core i7/ i5/ i3/Pentium/Celeron processor
  - LGA1150 socket
- **Chipset**
  - Intel® Q87/H81 PCH
- **System Memory**
  - 240-pin DDR3/DDR3L DIMM sockets
    - Four DIMM sockets for Q87 SKU
    - Two DIMM sockets for H81 SKU
  - 1333MHz or 1600MHz
  - Up to 32GB
- **BIOS**
  - AMI uEFI BIOS
  - 8MB SPI Flash ROM
- **iAMT**
  - iAMT9.0 for Q87 SKU only
- **Graphics**
  - Intel® HD Graphics Gen 8 integrated within CPU
  - Three displays supported
  - DisplayPort interface supports up to 3840x2160@60Hz
  - HDMI interface supports up to 4096x2304@24Hz or 2560x1600@60Hz
  - DVI-I/LVDS/VGA interface supports up to 1920x1200@60Hz
- **Ethernet**
  - One Intel® I217LM GbE PHY (LAN1)
  - One Intel® I210AT GbE Controller (LAN2)
  - 10/100/1000 Base-Tx GbE compatible
  - Both LAN1 & LAN2 with WOL/PXE support
- **Audio**
  - Realtek ALC886
  - Line-In, Line-Out and Mic-In
- **Expansion Interface**
  - One PCI Express x16

- One PCI Express x4 (4 lanes for Q87 SKU; 2 lanes for H81 SKU)
- One mini PCI Express (full size)
- Two PCI slots

- **Internal I/O**
  - SATA3 Port
    - 6 x SATA3 ports for Q87 SKU
    - 2 x SATA3 ports for H81 SKU
  - SATA2 Port
    - 2 x SATA2 ports for H81 SKU only
  - USB2.0 Port
    - 8 x USB2.0 ports for Q87 SKU
    - 4 x USB2.0 ports for H81 SKU
  - RS-232 Port
    - 4 x RS-232 ports for Q87 SKU
    - 8 x RS-232 ports for H81 SKU
  - 1 x PS/2 keyboard and mouse
  - 1 x 8-bit GPIO
  - 1 x front panel audio
  - 1 x S/PDIF in and out
  - 1 x Front bezel interface
  - 1 x standard ATX power connector
  - 1 x CPU power input connector
  - 1 x +5VSB and GND output connector
  - 1 x battery socket for CR-2032 battery
  - 3 x 4-pin fan connectors
- **External I/O**
  - 1 x DP
  - 1 x HDMI
  - 1 x DVI-D
  - 1 x VGA
  - 2 x RS232/422/485
  - 2 x GbE
  - 4 x USB3.0 (2xUSB3.0 & 2xUSB2.0 for H81 SKU)
  - 1 x Mic-In
  - 1 x Line-In
  - 1 x Line-Out

- **Watchdog Timer**
- **H/W Monitor**
- **Power Management**
  - ACPI 4.0a(Advanced Configuration and Power Interface)
- **Form Factor**
  - Micro-ATX, 244mm x 244mm

2.3 Block Diagram



2.4 SKU

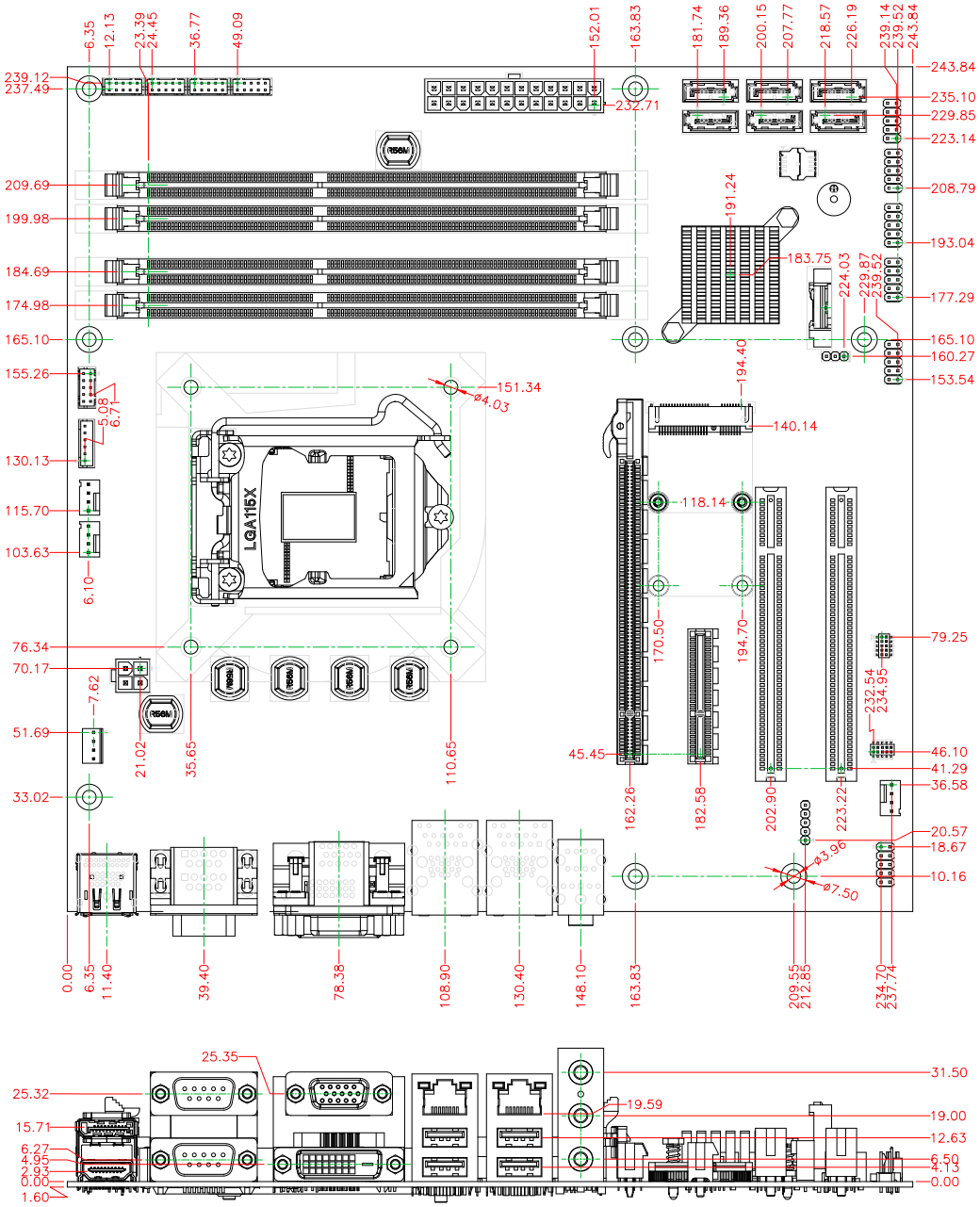
Product Number	Processor	PCH	Features
CT-MHW01	Intel 4th Gen LGA1150	Q87	4xDDR3, DP, HDMI, VGA, DVI-D, 2xGbE, 4xUSB3.0, 12xUSB2.0, 6xSATA, 6xCOM, Audio, KB/MS, GPIO, mini-PCIe, 2xPCI, PCIex16, PCIex4 (with 4 lanes), iAMT9.0, RAID0, 1, 5, 10
CT-MHW02	Intel 4th Gen LGA1150	H81	2xDDR3, DP, HDMI, VGA, DVI-D, 2xGbE, 2xUSB3.0, 8xUSB2.0, 4xSATA, 10xCOM, Audio, KB/MS, GPIO, mini-PCIe, 2xPCI, PCIex16, PCIex4 (with 2 lanes)

III. Mechanical Specification

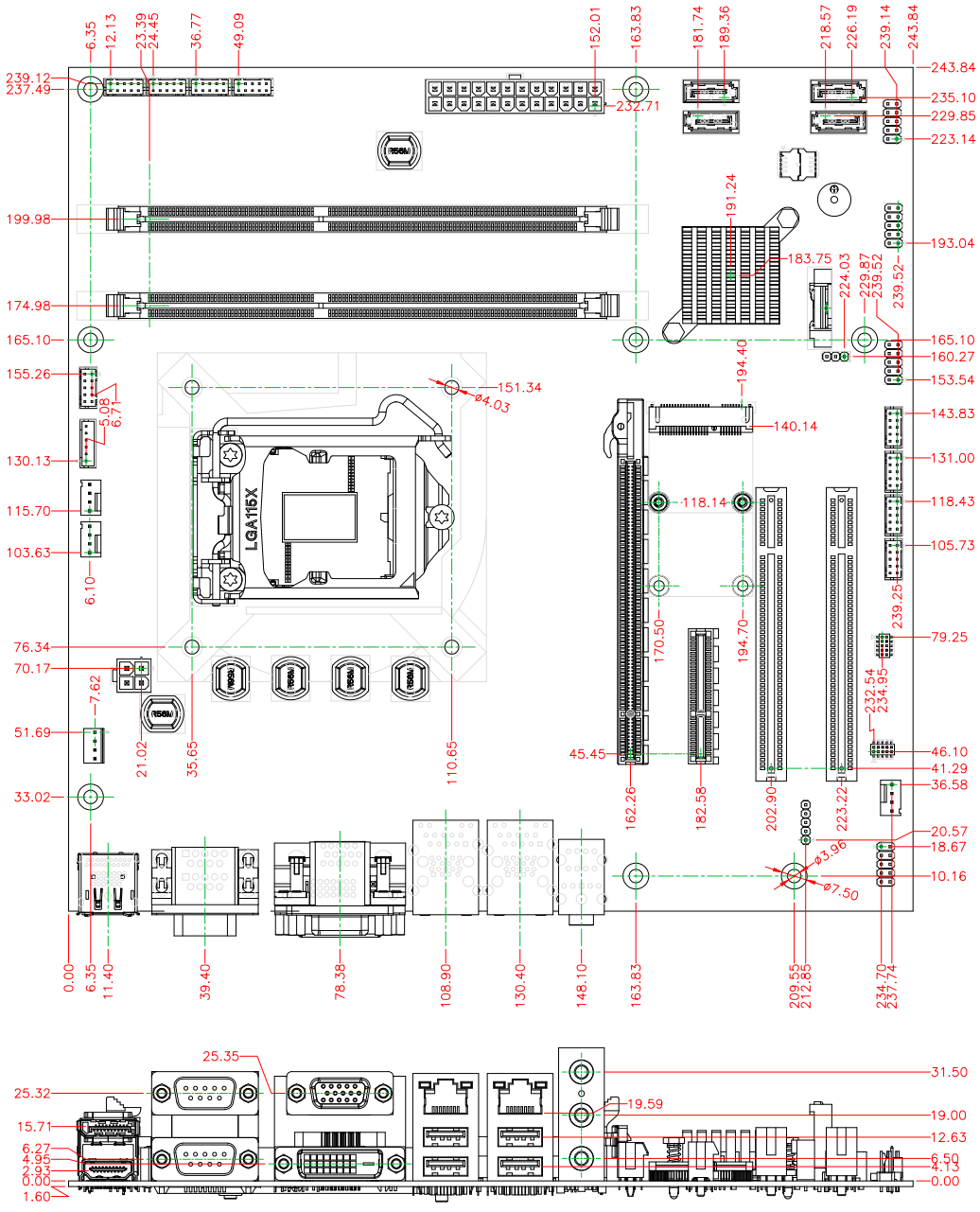
3.1 Module Dimensions

The PCB size of CT-MHW0X is 244mm x 244mm, the standard micro-ATX size.

3.1.1 CT-MHW01



3.1.2 CT-MHW02


LGA115X
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36.77
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181.74
189.36
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226.19
239.14
243.84
239.12
237.49
232.71
235.10
229.85
223.14
199.98
191.24
193.04
183.75
224.03
229.87
239.52
174.98
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155.26
151.34
Ø4.03
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140.14
143.83
131.00
130.13
118.14
118.43
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105.73
103.63
6.10
170.50
194.70
239.25
79.25
76.34
70.17
232.54
234.95
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51.69
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33.02
162.26
182.58
202.90
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36.58
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Ø7.50
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212.85
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237.74
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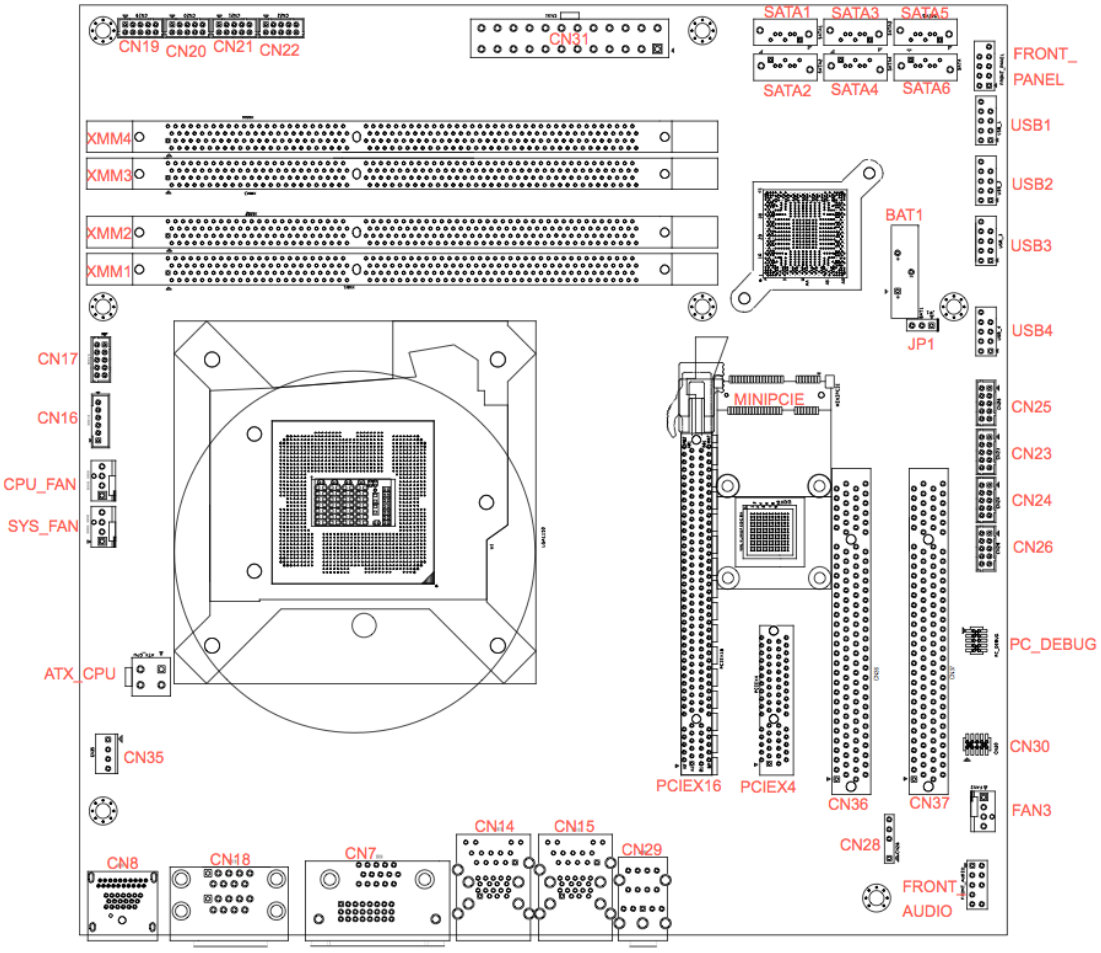
3.2 Layout


CN19
CN20
CN21
CN22
CN31
SATA1
SATA3
SATA5
SATA2
SATA4
SATA6
FRONT_
PANEL
USB1
USB2
USB3
USB4
XMM4
XMM3
XMM2
XMM1
BAT1
JP1
CN17
CN16
CPU_FAN
SYS_FAN
MINIPCIE
CN25
CN23
CN24
CN26
PC_DEBUG
ATX_CPU
CN35
CN30
FAN3
PCIEX16
PCIEX4
CN36
CN37
CN28
CN14
CN15
CN29
CN8
CN18
CN7
FRONT_
AUDIO

3.2.1 Connectors

Connector	Description
ATX_CPU	CPU Power Connector
CN7	VGA & DVI-D Connectors
CN8	Display Port & HDMI Connectors
CN14	Two USB3.0 & LAN Connectors
CN15	Two USB3.0 & LAN Connectors (USB2.0 for H81 SKU)
CN16	Keyboard/Mouse Wafer Connector
CN17	GPIO Wafer Connector
CN18	Two RS-232/422/485 Connectors
CN19~CN22	Four RS-232 Connectors
CN23~CN26	Four RS-232 Connectors for H81 SKU only
CN28	Audio S/PDIF Wafer Connector
CN29	Front Audio Jacks
LPC_DEBUG	JTAG Connector
CN31	ATX Power Connector
CN35	5V Output Wafer
CN36~CN37	Two PCI Slots
SATA1~SATA2	SATA Port 1 and 2 Connectors
SATA3~SATA4	SATA Port 3 and 4 Connectors for Q87 SKU only
SATA5~SATA6	SATA Port 5 and 6 Connectors
USB_1	Two USB2.0 Ports for Q87 SKU only
USB_2	Two USB2.0 Ports
USB_3	Two USB2.0 Ports for Q87 SKU only
USB_4	Two USB2.0 Ports
FRONT_AUDIO	Front Audio Wafer Connector
FRONT_PANEL	Front Bezel Pin Header
XMM1	DDR3 DIMM Socket
XMM2	DDR3 DIMM Socket for Q87 SKU only
XMM3	DDR3 DIMM Socket
XMM4	DDR3 DIMM Socket for Q87 SKU only
PCIE_x4	PCI Express x4
PCIE_x16	PCI Express x16
MINI_PCIE	Mini PCI Express
BAT1	Battery Socket
CPU_FAN	CPU Fan Wafer
SYS_FAN	System Fan Wafer
FAN3	Rear Chassis Fan Wafer

3.2.2 Jumper

Jumper	Description
JP1	Clear CMOS

3.3 Internal Connectors

3.3.1 CPU Power Connector: ATX_CPU

Connector Type: 2x2-pin ATX power connector

Pin	Signal	Pin	Signal
1	GND	3	+12V
2	GND	4	+12V

3.3.2 KB/MS Connector: CN16

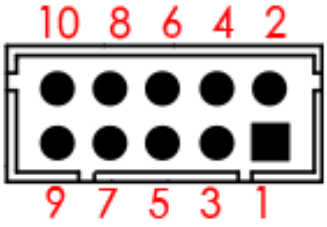
Connector Type: 1x6-pin pitch 2.0mm wafer connector

Pin	Signal
1	KB_DATA
2	KB_CLK
3	+5V
4	GND
5	MS_DATA
6	MS_CLK

3.3.3 GPIO Connector: CN17

Connector Type: 2x5-pin pitch 2.0mm wafer connector

Pin	Signal	Pin	Signal
1	+5V	2	GND
3	GPO0	4	GPI0
5	GPO1	6	GPI1
7	GPO2	8	GPI2
9	GPO3	10	GPI3

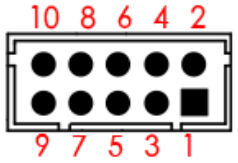


3.3.4 RS-232 Connector: CN19~CN26

Connector Type: 2x5-pin pitch 2.0mm wafer connector

Note: CN23~CN26 are for H81 SKU only

Pin	Signal	Pin	Signal
1	DCD, Data Carrier Detect	2	DSR, Data Set Ready
3	RXD, Receive Data	4	RTS, Request To Send
5	TXD, Transmit Data	6	CTS, Clear To Send
7	DTR, Data Terminal Ready	8	RI, Ring Indicator
9	GND	10	NC



3.3.5 Audio S/PDIF Connector: CN28

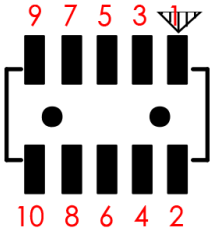
Connector Type: 1x5-pin pitch 2.54mm pin header

Pin	Signal
1	+5V
2	KEY
3	SPDIF_OUT
4	GND
5	SPDIF_IN

3.3.6 JTAG Connector: LPC_DEBUG

Connector Type: 2x5 pin pitch 1.27mm

Pin	Signal	Pin	Signal
1	+3.3V	2	GND
3	TDO	4	GND
5	TDI	6	GND
7	TMS	8	GND
9	TCK	10	GND

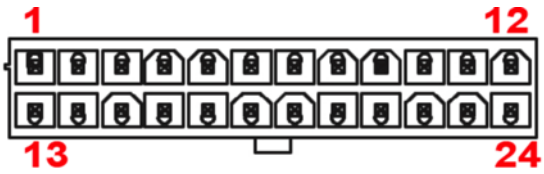


3.3.7 ATX Power Connector: CN31

Connector Type: 2x12-pin standard ATX power connector

Pin	Signal	Pin	Signal
1	+3.3V	13	+3.3V
2	+3.3V	14	-12V
3	GND	15	GND

Pin	Signal	Pin	Signal
4	+5V	16	PSON
5	GND	17	GND
6	+5V	18	GND
7	GND	19	GND
8	PWROK	20	-5V
9	5VSB	21	+5V
10	+12V	22	+5V
11	+12V	23	+5V
12	+3.3V	24	GND



3.3.8 5V Output Connector: CN35

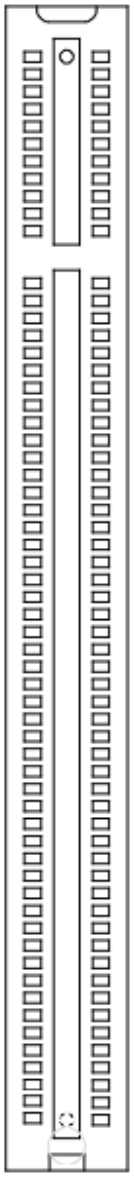
Connector Type: 1x4 pin pitch 2.0mm Wafer Connector

Pin	Signal
1	+5V
2	+5V
3	GND
4	GND

3.3.9 PCI Slots: CN36 & CN37

Pin	Signal	Pin	Signal
B1	-12V	A1	TRST#
B2	TCK	A2	+12V
B3	Ground	A3	TMS
B4	TDO	A4	TDI
B5	+5V	A5	+5V
B6	+5V	A6	INTA#
B7	INTB#	A7	INTC#
B8	INTD#	A8	+5V
B9	PRSNT1#	A9	Reserved
B10	Reserved	A10	+5V (I/O)
B11	PRSNT2#	A11	Reserved
B14	Reserved	A14	3.3Vaux
B15	Ground	A15	RST#
B16	CLK	A16	+5V (I/O)

Pin	Signal	Pin	Signal
B17	Ground	A17	GNT#
B18	REQ#	A18	Ground
B19	+5V (I/O)	A19	PME#
B20	AD[31]	A20	AD[30]
B21	AD[29]	A21	+3.3V
B22	Ground	A22	AD[28]
B23	AD[27]	A23	AD[26]
B24	AD[25]	A24	Ground
B25	+3.3V	A25	AD[24]
B26	C/BE[3]#	A26	IDSEL
B27	AD[23]	A27	+3.3V
B28	Ground	A28	AD[22]
B29	AD[21]	A29	AD[20]
B30	AD[19]	A30	Ground
B31	+3.3V	A31	AD[18]
B32	AD[17]	A32	AD[16]
B33	C/BE[2]#	A33	+3.3V
B34	Ground	A34	FRAME#
B35	IRDY#	A35	Ground
B36	+3.3V	A36	TRDY#
B37	DEVSEL#	A37	Ground
B38	Ground	A38	STOP#
B39	LOCK#	A39	+3.3V
B40	PERR#	A40	Reserved
B41	+3.3V	A41	Reserved
B42	SERR#	A42	Ground
B43	+3.3V	A43	PAR
B44	C/BE[1]#	A44	AD[15]
B45	AD[14]	A45	+3.3V
B46	Ground	A46	AD[13]
B47	AD[12]	A47	AD[11]
B48	AD[10]	A48	Ground
B49	Ground	A49	AD[09]
B52	AD[08]	A52	C/BE[0]#
B53	AD[07]	A53	+3.3V



Pin	Signal	Pin	Signal
B54	+3.3V	A54	AD[06]
B55	AD[05]	A55	AD[04]
B56	AD[03]	A56	Ground
B57	Ground	A57	AD[02]
B58	AD[01]	A58	AD[00]
B59	+5V (I/O)	A59	+5V (I/O)
B60	ACK64#	A60	REQ64#
B61	+5V	A61	+5V
B62	+5V	A62	+5V

3.3.10 SATA III Connector: SATA1~6:

Connector Type: 7-pin SATA connector

Note: SATA3 and SATA4 are for Q87 SKU only

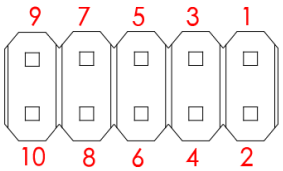
Pin	Signal
1	GND
2	SATA_TX+
3	SATA_TX-
4	GND
5	SATA_RX-
6	SATA_RX+
7	GND

3.3.11 USB2.0 Connector: USB_1~USB_4

Connector Type: 2x5-pin pitch 2.54mm pin header connector

Note: USB_1 and USB_3 are for Q87 SKU only

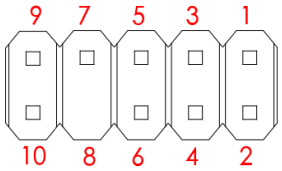
Pin	Signal	Pin	Signal
1	+5V	2	+5V
3	USB_D-	4	USB_D-
5	USB_D+	6	USB_D+
7	GND	8	GND
9	KEY	10	N.C.



3.3.12 Front Panel Audio Connector: FRONT_AUDIO

Connector Type: 2x5-pin pitch 2.54mm pin header connector

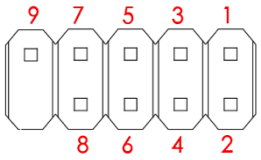
Pin	Signal	Pin	Signal
1	MIC-IN-L	2	AGND
3	MIC-IN-R	4	PRESENCE#
5	LINE-IN-R	6	MIC-IN Detect
7	SENSE_SEND	8	KEY
9	LINE-IN-L	10	LINE-IN Detect



3.3.13 Front Bezel Connector: FRONT_PANEL

Connector Type: 2x5-pin pitch 2.54mm pin header connector

Pin	Signal		Pin	Signal	
1	+5V	HDD	2	+5V	PWR
3	HDDLED	LED	4	GND	LED
5	GND	RESET	6	PWRBT	PWR
7	Reset BTN	Switch	8	GND	Button
9	+5V		10	Key	



3.3.14 Memory Sockets: XMM1~XMM4

Connector Type: 240-pin DDR3/DDR3L DIMM socket

Note: XMM2 and XMM4 are for Q87 SKU only.

Pin	Signal Front	Pin	Signal Front	Pin	Signal Back	Pin	Signal Back
1	VREF_DQDDRA/B	61	M_MAA_A/B2	121	GND	181	M_MAA_A/B1
2	GND	62	DDR_15V	122	M_DATA_A/B4	182	DDR_15V
3	M_DATA_A/B0	63	CK_M_DDR1_A/B_DP	123	M_DATA_A/B5	183	DDR_15V
4	M_DATA_A/B1	64	CK_M_DDR1_A/B_DN	124	GND	184	CK_M_DDR0_A/B_DP
5	GND	65	DDR_15V	125	GND	185	CK_M_DDR0_A/B_DN
6	M_DQS_A/B_DN0	66	DDR_15V	126	NC	186	DDR_15V
7	M_DQS_A/B_DP0	67	VREF_DDRA/B	127	GND	187	NC
8	GND	68	NC	128	M_DATA_A/B6	188	M_MAA_A/B0
9	M_DATA_A/B2	69	DDR_15V	129	M_DATA_A/B7	189	DDR_15V
10	M_DATA_A/B3	70	M_MAA_A/B10	130	GND	190	M_SBS_A/B1
11	GND	71	M_SBS_A/B0	131	M_DATA_A/B12	191	DDR_15V
12	M_DATA_A/B8	72	DDR_15V	132	M_DATA_A13	192	M_RAS_A_N
13	M_DATA_A/B9	73	M_WE_A/B_N	133	GND	193	M_SCS_A/B_N0,2
14	GND	74	M_CAS_A/B_N	134	GND	194	DDR_15V

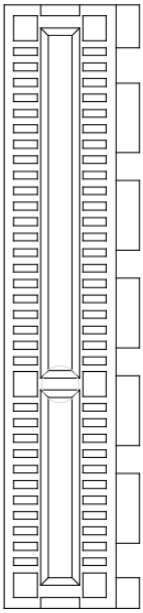
Pin	Signal Front	Pin	Signal Front	Pin	Signal Back	Pin	Signal Back
15	M_DQS_A/B_DN1	75	DDR_15V	135	NC	195	M_ODT_A/B0,2
16	M_DQS_A/B_DP1	76	M_SCS_A/B_N1,3	136	GND	196	M_MAA_A/B13
17	GND	77	M_ODT_A/B1,3	137	M_DATA_A/B14	197	DDR_15V
18	M_DATA_A/B10	78	DDR_15V	138	M_DATA_A/B15	198	NC
19	M_DATA_A/B11	79	NC	139	GND	199	GND
20	GND	80	GND	140	M_DATA_A/B20	200	M_DATA_A/B36
21	M_DATA_A/B16	81	M_DATA_A/B32	141	M_DATA_A/B21	201	M_DATA_A/B37
22	M_DATA_A/B17	82	M_DATA_A/B33	142	GND	202	GND
23	GND	83	GND	143	GND	203	GND
24	M_DQS_A/B_DN2	84	M_DQS_A/B_DN4	144	NC	204	NC
25	M_DQS_A/B_DP2	85	M_DQS_A/B_DP4	145	GND	205	GND
26	GND	86	GND	146	M_DATA_A/B22	206	M_DATA_A/B38
27	M_DATA_A/B18	87	M_DATA_A/B34	147	M_DATA_A/B23	207	M_DATA_A/B39
28	M_DATA_A/B19	88	M_DATA_A/B35	148	GND	208	GND
29	GND	89	GND	149	M_DATA_A/B28	209	M_DATA_A/B44
30	M_DATA_A/B24	90	M_DATA_A/B40	150	M_DATA_A/B29	210	M_DATA_A/B45
31	M_DATA_A/B25	91	M_DATA_A/B41	151	GND	211	GND
32	GND	92	GND	152	GND	212	GND
33	M_DQS_A/B_DN3	93	M_DQS_A/B_DN5	153	NC	213	NC
34	M_DQS_A/B_DP3	94	M_DQS_A/B_DP5	154	GND	214	GND
35	GND	95	GND	155	M_DATA_A/B30	215	M_DATA_A/B46
36	M_DATA_A/B26	96	M_DATA_A/B42	156	M_DATA_A/B31	216	M_DATA_A/B47
37	M_DATA_A/B27	97	M_DATA_A/B43	157	GND	217	GND
38	GND	98	GND	158	M_DATA_A/B_CB4	218	M_DATA_A/B52
39	M_DATA_A/B_CB0	99	M_DATA_A/B48	159	M_DATA_A/B_CB5	219	M_DATA_A/B53
40	M_DATA_A/B_CB1	100	M_DATA_A/B49	160	GND	220	GND
41	GND	101	GND	161	GND	221	GND
42	M_DQS_A/B_DN8	102	M_DQS_A/B_DN6	162	NC	222	NC
43	M_DQS_A/B_DP8	103	M_DQS_A/B_DP6	163	GND	223	GND
44	GND	104	GND	164	M_DATA_A/B_CB6	224	M_DATA_A/B54
45	M_DATA_A/B_CB2	105	M_DATA_A/B50	165	M_DATA_A/B_CB7	225	M_DATA_A/B55
46	M_DATA_A/B_CB3	106	M_DATA_A/B51	166	GND	226	GND
47	GND	107	GND	167	NC	227	M_DATA_A/B60
48	VTT2	108	M_DATA_A/B56	168	DDR3_RST_L	228	M_DATA_A/B61
49	TP	109	M_DATA_A/B57	169	M_SCKE_A/B1	229	GND

50	M_SCKE_A/B0,2	110	GND	170	DDR_15V	230	GND
51	DDR_15V	111	M_DQS_A/B_DN7	171	M_MAA_A/B15	231	NC
52	M_SBS_A/B2	112	M_DQS_A/B_DP7	172	M_MAA_A/B14	232	GND
53	NC	113	GND	173	DDR_15V	233	M_DATA_A/B62
54	DDR_15V	114	M_DATA_A/B58	174	M_MAA_A/B12	234	M_DATA_A/B63
55	M_MAA_A/B11	115	M_DATA_A/B59	175	M_MAA_A/B9	235	GND
56	M_MAA_A/B7	116	GND	176	DDR_15V	236	VCC3
57	DDR_15V	117	VCC3	177	M_MAA_A/B8	237	GND
58	M_MAA_A/B5	118	SMBCLK	178	M_MAA_A/B6	238	SMBDATA
59	M_MAA_A/B4	119	GND	179	DDR_15V	239	GND
60	DDR_15V	120	DDRVTT	180	M_MAA_A/B3	240	DDRVTT

3.3.15 PCI Express x4 Connector: PCIE_x4

Note: Only 2 lanes for H81 SKU

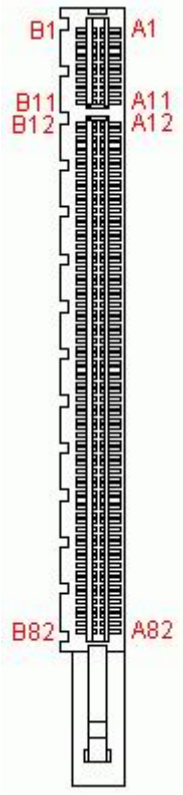
Pin	Signal	Pin	Signal
B1	+12V	A1	N.C.
B2	+12V	A2	+12V
B3	N.C.	A3	+12V
B4	GND	A4	GND
B5	SMCLK	A5	TCK
B6	SMDAT	A6	TDI
B7	GND	A7	NC
B8	3V3SB	A8	TMS
B9	TRST#	A9	3V3SB
B10	3V3SB	A10	3V3SB
B11	WAKE#	A11	PERST#
B12	N.C.	A12	GND
B13	GND	A13	REFCLK+
B14	PETp0	A14	REFCLK-
B15	PETn0	A15	GND
B16	GND	A16	PERp0
B17	N.C.	A17	PERn0
B18	GND	A18	GND
B19	PETp1	A19	NC
B20	PETn1	A20	GND
B21	GND	A21	PERp1



Pin	Signal	Pin	Signal
B22	GND	A22	PERn1
B23	PETp2	A23	GND
B24	PETn2	A24	GND
B25	GND	A25	PERp2
B26	GND	A26	PERn2
B27	PETp3	A27	GND
B28	PETn3	A28	GND
B29	GND	A29	PERp3
B30	NC	A30	PERn3
B31	NC	A31	GND
B32	GND	A32	NC

3.3.16 PCI Express x16 Connector: PCIE_x16

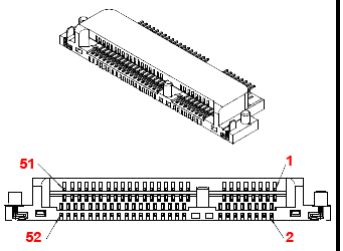
Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
B1	+ 12V	B42	PETn6	A1	N.C.	A42	GND
B2	+ 12V	B43	GND	A2	+ 12V	A43	PERp6
B3	N.C.	B44	GND	A3	+ 12V	A44	PERn6
B4	GND	B45	PETp7	A4	GND	A45	GND
B5	SMCLK	B46	PETn7	A5	TCK	A46	GND
B6	SMDAT	B47	GND	A6	TDI	A47	PERp7
B7	GND	B48	N.C.	A7	N.C.	A48	PERn7
B8	3V3SB	B49	GND	A8	TMS	A49	GND
B9	TRST#	B50	PETp8	A9	3V3SB	A50	N.C.
B10	3V3SB	B51	PETn8	A10	3V3SB	A51	GND
B11	WAKE#	B52	GND	A11	PERST#	A52	PERp8
B12	N.C.	B53	GND	A12	GND	A53	PERn8
B13	GND	B54	PETp9	A13	REFCLK+	A54	GND
B14	PETp0	B55	PETn9	A14	REFCLK-	A55	GND
B15	PETn0	B56	GND	A15	GND	A56	PERp9
B16	GND	B57	GND	A16	PERp0	A57	PERn9
B17	N.C.	B58	PETp10	A17	PERn0	A58	GND
B18	GND	B59	PETn10	A18	GND	A59	GND
B19	PETp1	B60	GND	A19	N.C.	A60	PERp10
B20	PETn1	B61	GND	A20	GND	A61	PERn10
B21	GND	B62	PETp11	A21	PERp1	A62	GND



Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
B22	GND	B63	PETn11	A22	PERn1	A63	GND
B23	PETp2	B64	GND	A23	GND	A64	PERp11
B24	PETn2	B65	GND	A24	GND	A65	PERn11
B25	GND	B66	PETp12	A25	PERp2	A66	GND
B26	GND	B67	PETn12	A26	PERn2	A67	GND
B27	PETp3	B68	GND	A27	GND	A68	PERp12
B28	PETn3	B69	GND	A28	GND	A69	PERn12
B29	GND	B70	PETp13	A29	PERp3	A70	GND
B30	N.C.	B71	PETn13	A30	PERn3	A71	GND
B31	N.C.	B72	GND	A31	GND	A72	PERp13
B32	GND	B73	GND	A32	N.C.	A73	PERn13
B33	PETp4	B74	PETp14	A33	N.C.	A74	GND
B34	PETn4	B75	PETn14	A34	GND	A75	GND
B35	GND	B76	GND	A35	PERp4	A76	PERp14
B36	GND	B77	GND	A36	PERn4	A77	PERn14
B37	PETp5	B78	PETp15	A37	GND	A78	GND
B38	PETn5	B79	PETn15	A38	GND	A79	GND
B39	GND	B80	GND	A39	PERp5	A80	PERp15
B40	GND	B81	N.C.	A40	PERn5	A81	PERn15
B41	PETp6	B82	N.C.	A41	GND	A82	GND

3.3.17 Mini PCIE Connector: MINI_PCIE

Pin	Signal	Pin	Signal	Pin	Signal
1	WAKE#	19	Reserved	37	Reserved
2	+3.3V	20	Reserved	38	USB_D+
3	Reserved	21	GND	39	Reserved
4	GND	22	PERST#	40	GND
5	Reserved	23	PERn0	41	Reserved
6	+1.5V	24	+3.3Vaux	42	LED_WWAN#
7	CLKREQ#	25	PERp0	43	Reserved
8	UIM_PWR	26	GND	44	LED_WLAN#
9	GND	27	GND	45	Reserved
10	UIM_DATA	28	+1.5V	46	LED_WPAN#
11	REFCLK-	29	GND	47	Reserved
12	UIM_CLK	30	SMB_CLK	48	+1.5V



Pin	Signal	Pin	Signal	Pin	Signal
13	REFCLK+	31	PETn0	49	Reserved
14	UIM_RESET	32	SMB_DATA	50	GND
15	GND	33	PETp0	51	Reserved
16	UIM_VPP	34	GND	52	+3.3V
17	Reserved	35	GND	53	GND
18	GND	36	USB_D-	54	GND

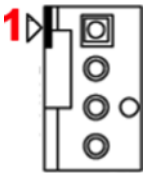
3.3.18 FAN Connector: CPU_FAN/SYS_FAN/FAN3

FAN1: CPU Fan Wafer Connector

FAN2: System Fan Wafer Connector

FAN3: Rear Chassis Fan Wafer

Pin	Signal
1	GND
2	+12V Fan Power
3	Fan Sensor
4	Fan PWM



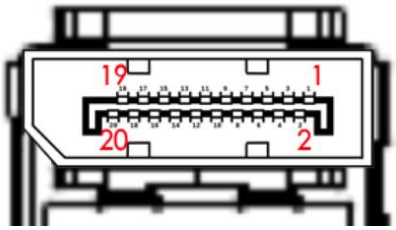
3.4 External Connectors

CN8 CN18 CN7 CN14 CN15 CN29

3.4.1 DP & HDMI Connectors: CN8

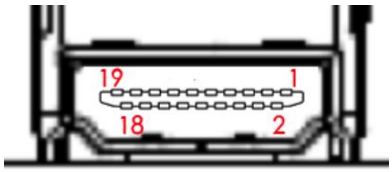
3.4.1.1 DisplayPort (Top)

Pin	Signal	Pin	Signal
1	DPC_TX0+	2	GND
3	DPC_TX0-	4	DPC_TX1+
5	GND	6	DPC_TX1-
7	DPC_TX2+	8	GND
9	DPC_TX2-	10	DPC_TX3+
11	GND	12	DPC_TX3-
13	CONFIG1	14	CONFIG2
15	DP_AUX_P	16	GND
17	DP_AUX_N	18	DP2_HDP_F
19	GND	20	+3.3V



3.4.1.2 HDMI (Bottom)

Pin	Signal	Pin	Signal
1	HDMI_TX2_DP_B	2	GND
3	HDMI_TX2_DN_B	4	HDMI_TX1_DP_B
5	GND	6	HDMI_TX1_DN_B
7	HDMI_TX0_DP_B	8	GND
9	HDMI_TX0_DN_B	10	HDMI_CLK_DP_B
11	GND	12	HDMI_CLK_DN_B
13	NC	14	NC
15	HDMI_SCLDDC_B	16	HDMI_SDADDC_B
17	GND	18	+5V
19	HDMI_PLUG_B20		

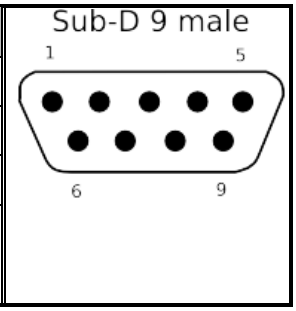


3.4.2 COM Connectors：CN18

RS-232/422/485 function selectable by BIOS

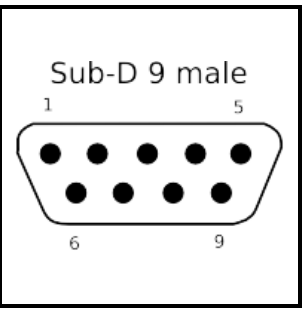
3.4.2.1 RS-232

Pin	Signal	Pin	Signal
1	DCD, Data Carrier Detect	6	DSR, Data Set Ready
2	RXD, Receive Data	7	RTS, Ready To Send
3	TXD, Transmit Data	8	CTS, Clear To Send
4	DTR, Data Terminal Ready	9	RI, Ring Indicator
5	GND, Ground		



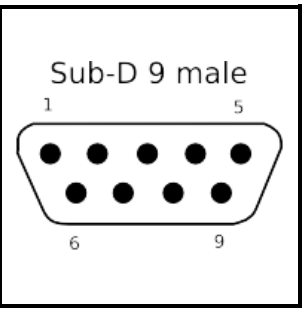
3.4.2.2 RS-422

Pin	Signal	Pin	Signal
1	TXD-, Transmit Data	6	NA
2	TXD+, Transmit Data	7	NA
3	RXD+, Receive Data	8	NA
4	RXD-, Receive Data	9	NA
5	NA		



3.4.2.3 RS-485

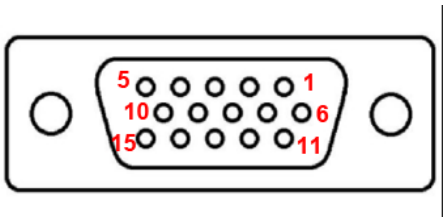
Pin	Signal	Pin	Signal
1	DATA-	6	NA
2	DATA+	7	NA
3	NA	8	NA
4	NA	9	NA
5	NA		



3.4.3 VGA and DVI-D Connectors：CN7

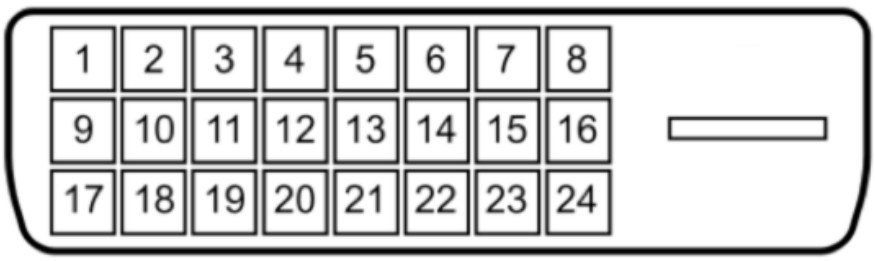
3.4.3.1 VGA (Top)

Pin	Signal	Pin	Signal
1	VGA_RED	9	VCC
2	VGA_GRN	10	GND
3	VGA_BLU	11	NC
4	NC	12	VGA_DDC_DAT
5	GND	13	VGA_HSYNC
6	GND	14	VGA_VSYNC
7	GND	15	VGA_DCC_CLK
8	GND		



3.4.3.2 DVI-D (Bottom)

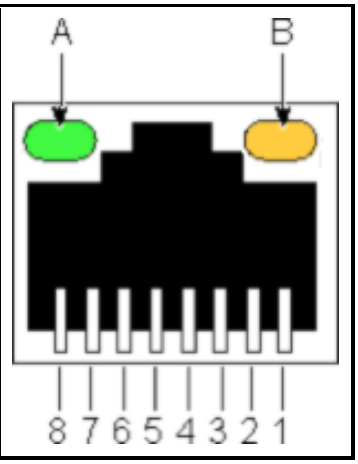
Pin	Signal	Pin	Signal	Pin	Signal
1	TMDS Data2- Digital Red-(link1)	9	TMDS Data1- Digital Green-(link1)	17	TMDS Data0- Digital Blue-(link1) & Digital Sync
2	TMDS Data2+ Digital Red+(link1)	10	TMDS Data1+ Digital Green+(link1)	18	TMDS Data0+ Digital Blue+ (link1) & Digital Sync
3	Data2/4 Shield	11	Data1/3 Shield	19	Data0/5 Shield
4	TMDS Data4- Digital Green-(link2)	12	TMDS Data3- Digital Blue-(link2)	20	TMDS Data5- Digital Red-(link2)
5	TMDS Data4+ Digital Green+(link2)	13	TMDS Data3+ Digital Blue+(link2)	21	TMDS Data5+ Digital Red+(link2)
6	DDC Clock	14	+5V	22	TMDS clock shield
7	DDC Data	15	GND	23	TMDS Clock+
8	Analog Vertical Sync	16	Hot Plug Detect	24	TMDS Clock-



3.4.4 RJ-45 LAN & USB Connectors: CN14/CN15

3.4.4.1 RJ-45 (Top)

Pin	Signal
1	MDI0+
2	MDI0-
3	MDI1+
4	MDI2+
5	MDI2-
6	MDI1-
7	MDI3+
8	MDI3-



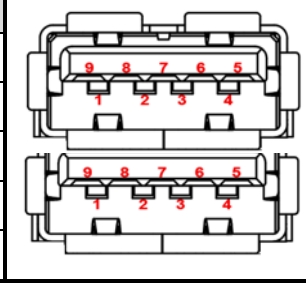
LED A	Status	LED B	Status
Yellow Blink	Active	OFF	Speed 10
		Green	Speed 100
		Orange	Speed 1000

3.4.4.2 USB Connectors (Bottom)

CN15 connector supports USB2.0 only for H81 SKU.

3.4.4.2.1 USB3.0 (Bottom)

Pin	Signal	Pin	Signal
1	USB +5V	5	USB_SSRX-
2	USB-	6	USB_SSRX+
3	USB+	7	GND_DRAIN
4	GND	8	USB_SSTX-
		9	USB_SSTX+

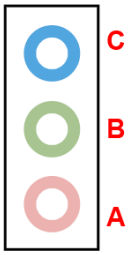


3.4.4.2.2 USB 2.0 Connectors: CN15

Pin	Signal (USB4)	Pin	Signal (USB5)
1	USB +5V	5	USB +5V
2	USB_D-	6	USB_D-
3	USB_D+	7	USB_D+
4	GND	8	GND

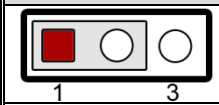
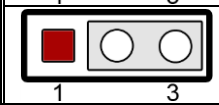
3.4.5 Front Audio Jack: CN29

Pin	Signal
C (Blue)	Lin-In
B (Green)	Line-Out
A (Pink)	Mic-In



3.5 Jumper Setting

3.5.1 Clear CMOS: JP1

Function	Setting	Jumper
Normal (Default)	1-2 closed	
Clear CMOS	2-3 closed	

IV. Features & Interfaces

4.1 Processor

The CT-MHW0X with LGA1150 socket supports Intel® 4th Generation Core i7/ i5/ i3/ Pentium /Celeron type processor. This 64-bit and multi-core mobile processor built on 22-nanometer process technology. This architecture consists a processor and Platform Controller Hub (PCH) to form a two-chip platform. The processor includes Integrated Memory Controller, which supports DDR3/DDR3L, and provides Direct Media Interface (DMI), Digital Display Interface (DDI) and PCI Express.

4.2 BIOS

The AMI uEFI BIOS, 8MB SPI Flash Rom is used in the CT-MHW0X module.

4.3 System Memory

The Integrated Memory Controller (IMC) of the processor supports DDR3/DDR3L protocols with two independent, 64-bit wide channels. For Q87 SKU, each channel access two DIMM socket; for H81 SKU, each channel access one DIMM sockets. The data transfer rate is 1333/1600MHz. With standard 1-Gb, 2-Gb and 4-Gb DDR3 DRAM technologies, these DIMM sockets on the CT-MHW0X support the maximum memory of 32GB. However, the memory size of the first channel, XMM_1 and XMM_2,must be greater or equal to the memory size of the second channel, XMM_3 and XMM_4.

4.4 Chipset

The Platform Controller Hub (PCH) used on CT-MHW0X is Q87/H81. The PCH provides extensive I/O support.

4.5 Graphics

The CT-MHW0X platform with the Intel® 4th Generation and the Q87/H81 Platform Controller Hub can support up to 3 monitors.

The processor supports three Digital Display (x4 DDI) interfaces that can be configured as DisplayPort, HDMI, LVDS or DVI, and one dedicated Intel FDI Port for legacy VGA support on the PCH.

The 3 displays configuration of the CT-MHW0X is one DP, one HDMI and one of the three: LVDS, DVI or VGA.

The maximum resolution of each port can be support is as following:

DisplayPort: 3840x2160@60Hz
HDMI: 4096x2304@24Hz or 2560x1600@60Hz
DVI/VGA/LVDS: 1920x1200@60Hz

4.6 USB

The Intel® Q87/H81 PCH contains one eXtensible Host Controller Interface (xHCI) controller and two Enhanced Host Controller Interface (EHCI) controllers. The Q87 SKU offers eight USB2.0 ports and four USB3.0 ports; the H81 SKU offers six USB2.0 ports and two USB3.0 ports.

4.6.1 USB2.0

Signal	I/O	Description
USB_D+ USB_D -	I/O	USB differential pairs, channels 0 through 7, transmit Data/Address/Command signals.

4.6.2 USB 3.0

Signal	I/O	Description
USB_SSTX+ USB_SSTX-	O	Additional transmit signal differential pairs for the SuperSpeed USB data path.
USB_SSRX+ USB_SSRX-	I	Additional receive signal differential pairs for the SuperSpeed USB data path.

4.7 SATA

The PCH Q87/H81 has two integrated SATA host controllers that support independent DMA operation and supports data transfer rates of up to 6.0 Gb/s. Up to six Serial ATAII (SATA) ports are provided for Q87 SKU, and four SATA are for H81.

Signal	I/O	Description
SATA_TX+ SATA_TX-	O	Serial ATA or SAS transmits differential pairs.
SATA_RX+ SATA_RX-	I	Serial ATA or SAS receives differential pairs.

4.8 PCI Express

The processor contains one PCI Express controller that supports one external x16 PCI Express Graphics port. This port can also operate at Gen 3 speed, so it can operate at 2.5GT/s, 5GT/s, or 8GT/s.

Signal	I/O	Description
PETp[0:15] PETn[0:15]	O	PCI Express Differential transmit Pairs 0 through 15
PERp[0:15] PERn[0:15]	I	PCI Express Differential receive Pairs 0 through 15

4.9 High Definition Audio

The processor also integrates dedicated a Mini HD audio controller to drive audio on integrated digital display interfaces, such as HDMI and DisplayPort. The HD audio controller on the PCH would continue to support down CODECs, and so on. The processor Mini HD audio controller supports two High Definition Audio streams simultaneously on any of the three digital ports.

4.10 Ethernet

The Q87/H81 integrates a Gigabit Ethernet (GbE) controller. The controller with Intel® I217 LM PHY, which is connected to Port 1 of PCIex1, provides 10/100/1000Mb/s interface. The Intel® I210AT controller is connected to Port 2 of PCIex1 of the PCH to provide the second LAN.

Signal	I/O	Description
MDI[0:3]+ MDI[0:3]-	I/O	Gigabit Ethernet Controller 0: Media Dependent Interface Differential Pairs 0, 1, 2, 3. The MDI can operate in 1000, 100 and 10 Mbit/sec modes. Some pairs are unused in some modes, per the following: 1000BASE-T / 100BASE-TX / 10BASE-T MDI[0]+/- / B1_DA+/- / TX+/- / TX+/- MDI[1]+/- / B1_DB+/- / RX+/- / RX+/- MDI[2]+/- / B1_DC+/- MDI[3]+/- / B1_DD+/-

4.11 LPC

The LPC interface provides legacy I/O support.

Signal	I/O	Description
LPC_AD[0:3]	I/O	LPC multiplexed address, command and data bus
LPC_FRAME#	O	LPC frame indicates the start of an LPC cycle

4.12 Testability Signals (JTAG)

Signal	I/O	Description
TDO	OD	Test Data Output: TDO is the serial output for test instructions and data from the test logic defined in this standard.
TDI	I	Test Data Input: Serial test instructions and data are received by the test logic at TDI.
TMS	I	Test Mode Select: The signal is decoded by the Test Access Port (TAP) controller to control test operations.
TCK	I	Test Clock Input: The test clock input provides the clock for JTAG test logic.

4.13 General Purpose Input Output

GPI and GPO pins may be implemented as GPIO (Module specific). GPI and GPO pins may be implemented as GPIO.

Signal	I/O	Description
GPO[0:3]	O	General purpose output pins. Upon a hardware reset, these outputs should be low.
GPI[0:3]	I	General purpose input pins. Pulled high internally on the Module.

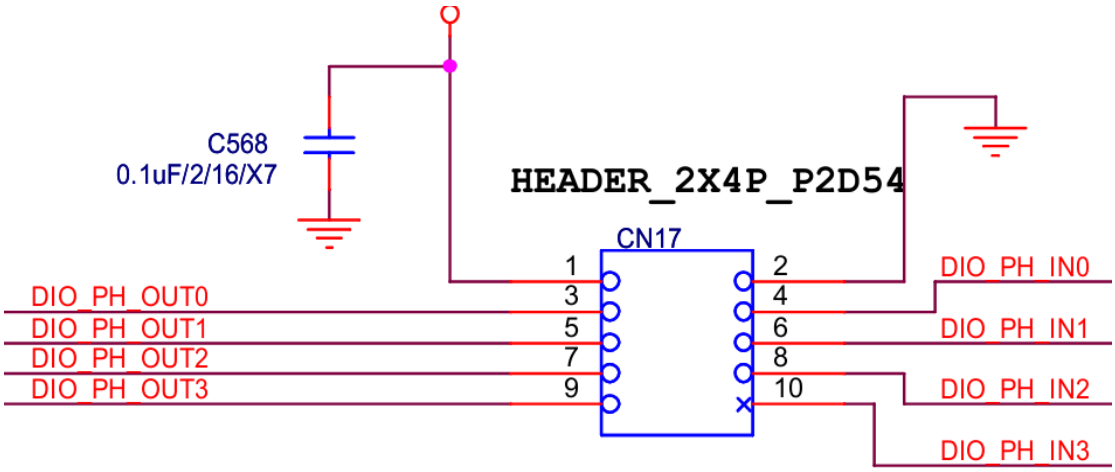
4.13.1 GPIO Configuration

4.13.1.1 Board Design

PIN#	GPIO#	Default Configuration
1	--	VCC3
2	--	GND
3	DIO_PH_OUT0	GPO0
4	DIO_PH_IN0	GPI0
5	DIO_PH_OUT1	GPO1
6	DIO_PH_IN1	GPI1
7	DIO_PH_OUT2	GPO2
8	DIO_PH_IN2	GPI2
9	DIO_PH_OUT3	GPO3
10	DIO_PH_IN3	GPI3

Notes

1. Output pin default setting is "**HIGH"**



GPIO function is provided by Fintek F81866A IC, which can be accessed through its GPIO index/data port. The index port is the base address +0 and the data port is the base address +1. To access the GPIO register, write index to the index port, and then read/write from/to data port. The configuration on CT-MHW0X is described as below.

Index Port	0xA00
Data Port	0xA01

4.13.1.2 Registers Description

4.13.1.2.1 GPIO Output Data Select

- GPIO Output Data Register

(Index port=0xA00, Data port=0xA01, Offset=0x89)

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
GPO3	GPO2	GPO1	GPO0	-	-	-	-

Note.

Bit X = 0 outputs 0 when in output mode

Bit X = 1 outputs 1 when in output mode

4.13.1.3 PSUEDO CODE

Example1 *Set GPO1 to output LOW*

```
Step1: WriteIOByte8(0xA00,0x89)          //Write configuration offset into index port
Step2: ByteData = ReadIOByte8(0xA01)      //Read data from data port
Step3: ByteData = ByteData & 0xDF         //Set Bit5 to 0 (output LOW)
Step4: WriteIOByte8(0xA01, ByteData)      //Write back this change
```

4.14 Watchdog Timer

4.14.1 Board Design

The WDT (Watchdog Timer) is implemented by using Fintek F81866A.

Register	Address
WDT Base Address	0xA10

4.14.2 PSUEDO CODE

- *Set WDT Time Unit (Second Unit)*

```
Step1: ByteData = ReadIOByte(0xA15)          //Read current setting
Step2: ByteData = ByteData & 0xF7            //Set time unit to "second"
Step3: WriteIOByte(0xA15, ByteData)          //Write back
```

- *Set WDT Time Value*

```
Step1: WriteIOByte(0xA16, Time)              //Set watch dog time value
```

■ *Enable WDT*

```
Step1: ByteData = ReadIOByte(0xA15)          //Read current setting
Step2: ByteData = ByteData | 0x20            //Enable WDT
Step3: WriteIOByte(0xA15, ByteData)          //Write back
```

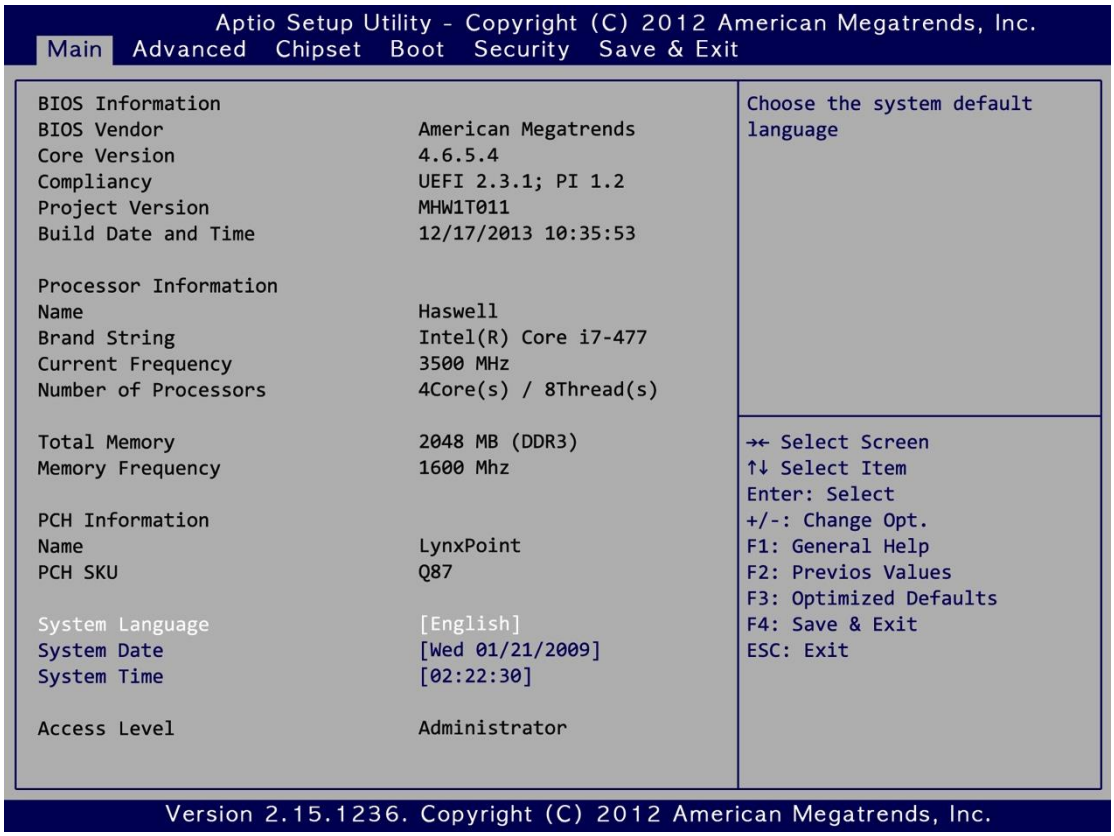
V. SYSTEM BIOS

The system BIOS software is stored on EEPROM. The BIOS provides an interface to modify the configuration. When the battery is removed, all the parameters will be reset.

Turn on the computer and press <DEL> or <F2> to enter the setup screens.

5.1 Main

The Main setup screen is showed as following when the setup utility is entered.



Project Version:

MHW1T011 is showed for CT-MHW01 model

MHW2T008 is showed for CT-MHW02 model

PCH SHU:

Q87 is showed for CT-MHW01 model

H81 is showed for CT-MHW02 model

System Date: MM/DD/YYYY

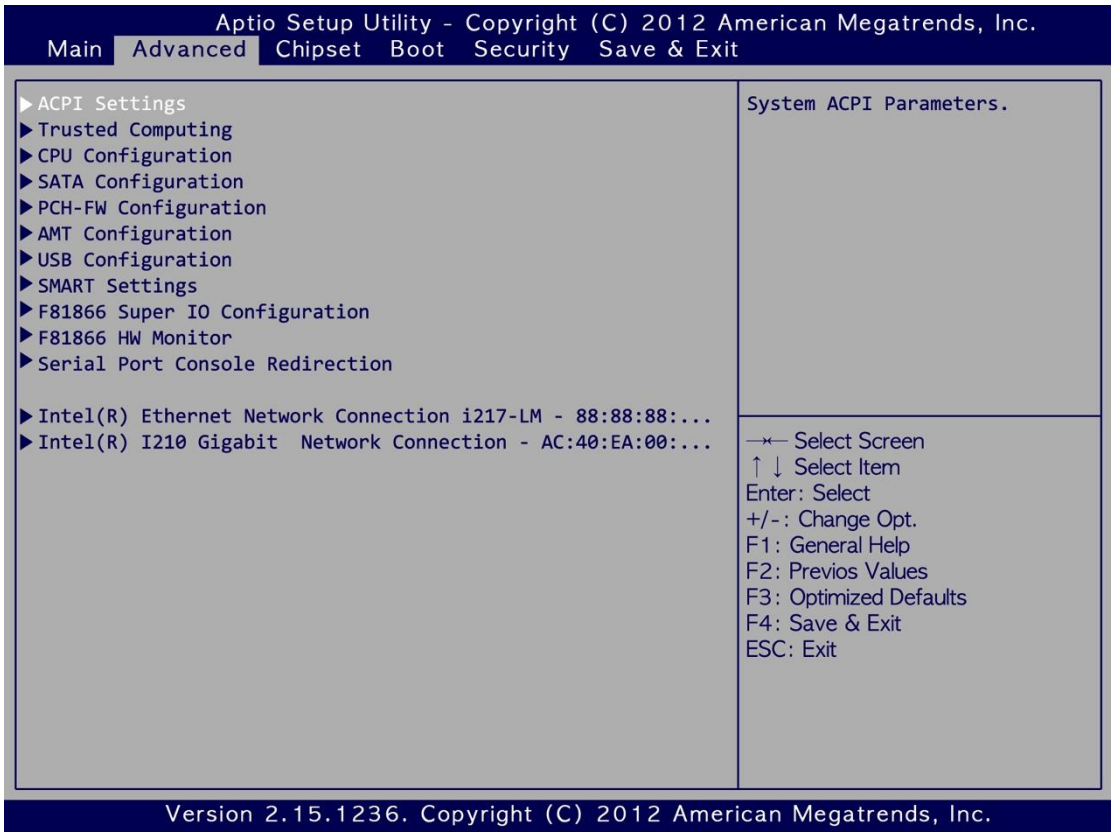
System Time: HH:MM:SS

Use Tab to switch between Date and Time elements.

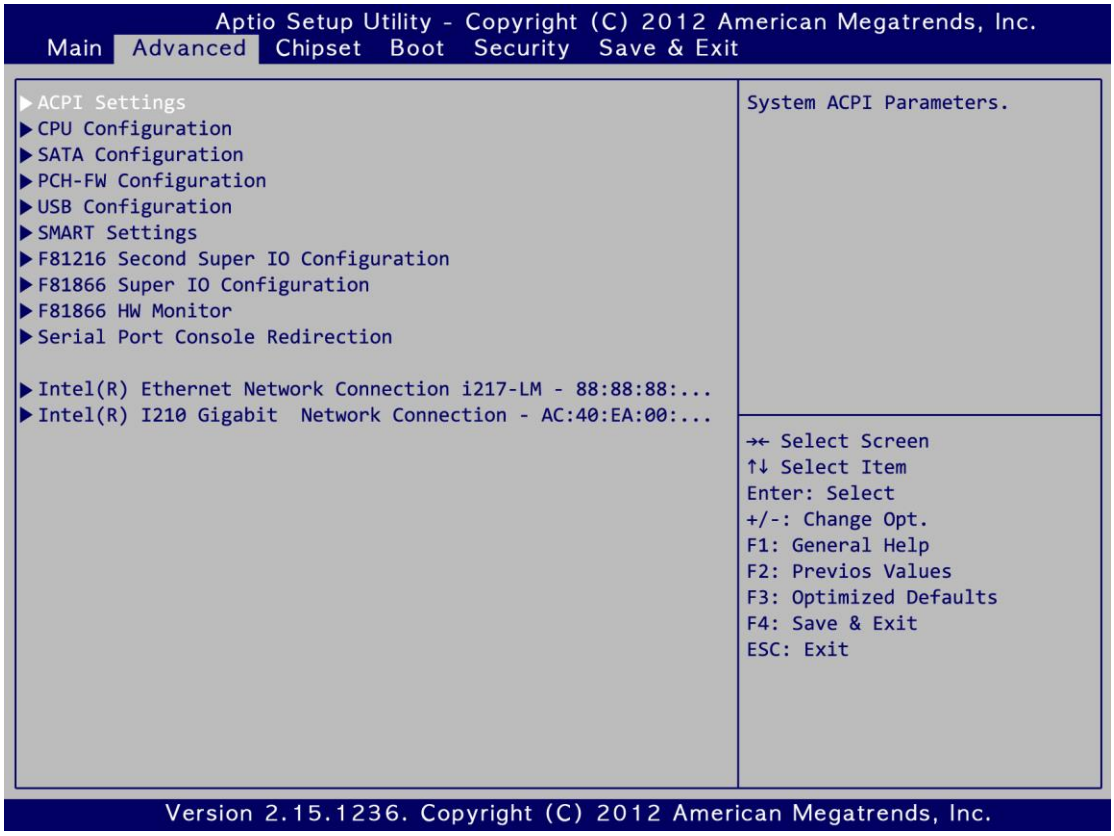
5.2 Advanced

The difference between CT-MHW01 and CT-MHW02 are:
No Trusted Computing and no AMT Configuration in CT-MHW02 model.
No F81216 Second Super IO Configuration in CT-MHW01 model.

- CT-MHW01

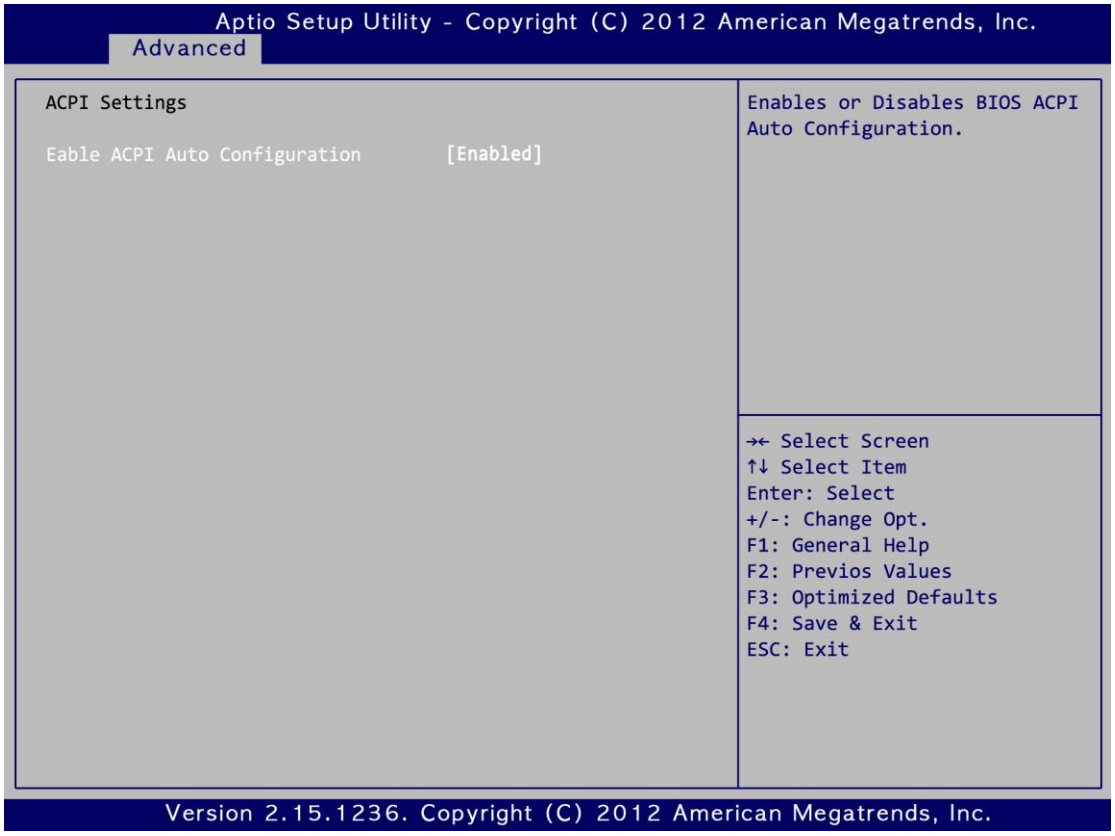


- CT-MHW02

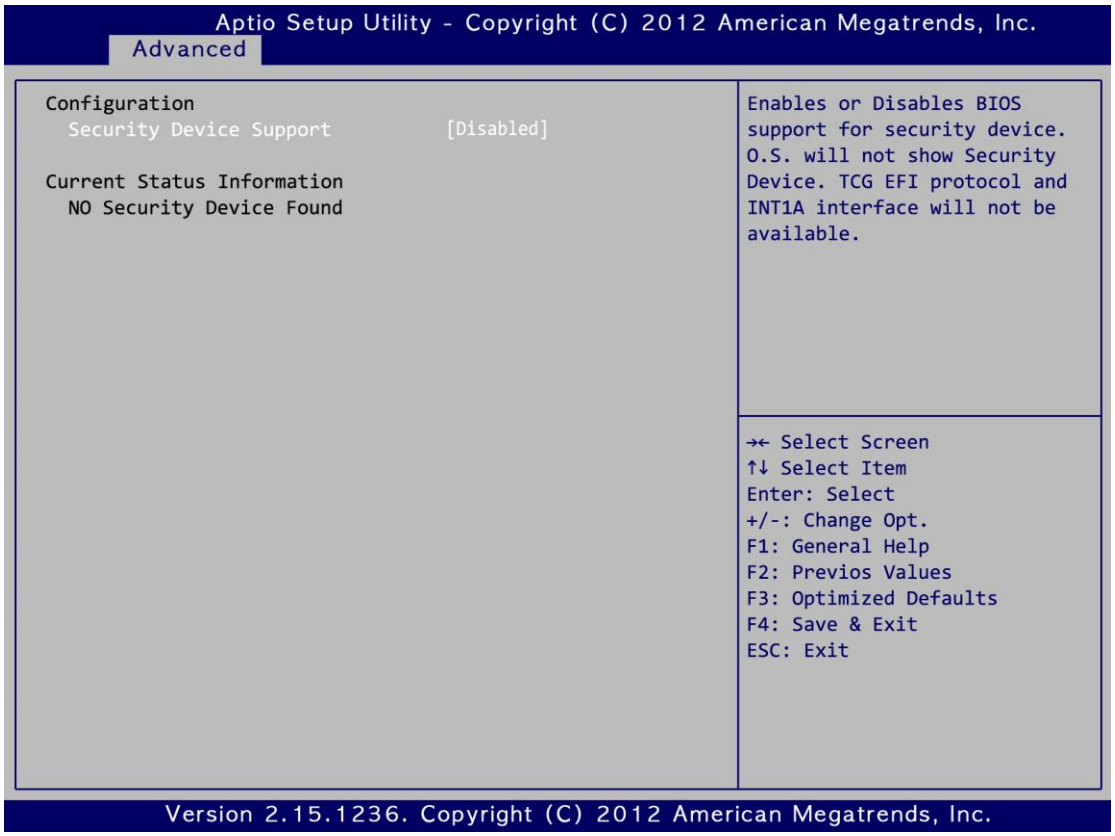

Aptio Setup Utility - Copyright (C) 2012 American Megatrends, Inc.
Main Advanced Chipset Boot Security Save & Exit
ACPI Settings
CPU Configuration
SATA Configuration
PCH-FW Configuration
USB Configuration
SMART Settings
F81216 Second Super IO Configuration
F81866 Super IO Configuration
F81866 HW Monitor
Serial Port Console Redirection
Intel(R) Ethernet Network Connection i217-LM - 88:88:88:...
Intel(R) I210 Gigabit Network Connection - AC:40:EA:00:...
System ACPI Parameters.
→← Select Screen
↑↓ Select Item
Enter: Select
+/-: Change Opt.
F1: General Help
F2: Previos Values
F3: Optimized Defaults
F4: Save & Exit
ESC: Exit
Version 2.15.1236. Copyright (C) 2012 American Megatrends, Inc.

5.2.1 ACPI Settings

System ACPI Parameter Setting.

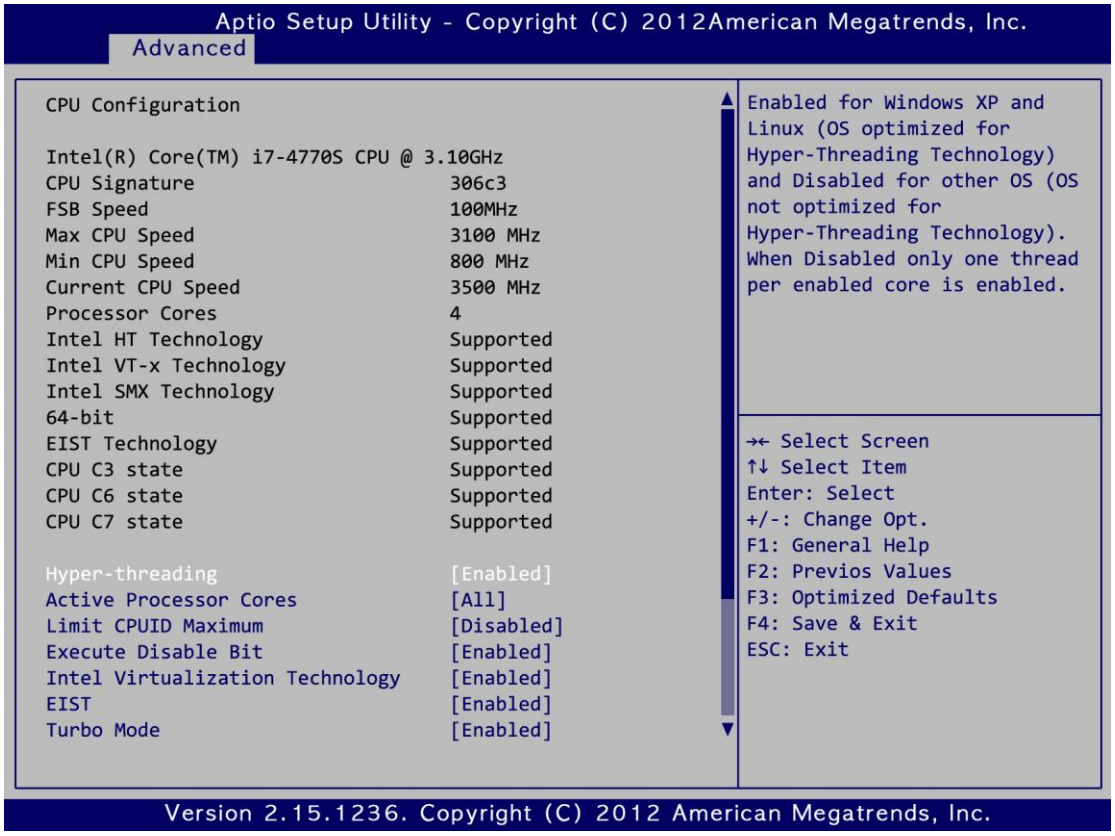


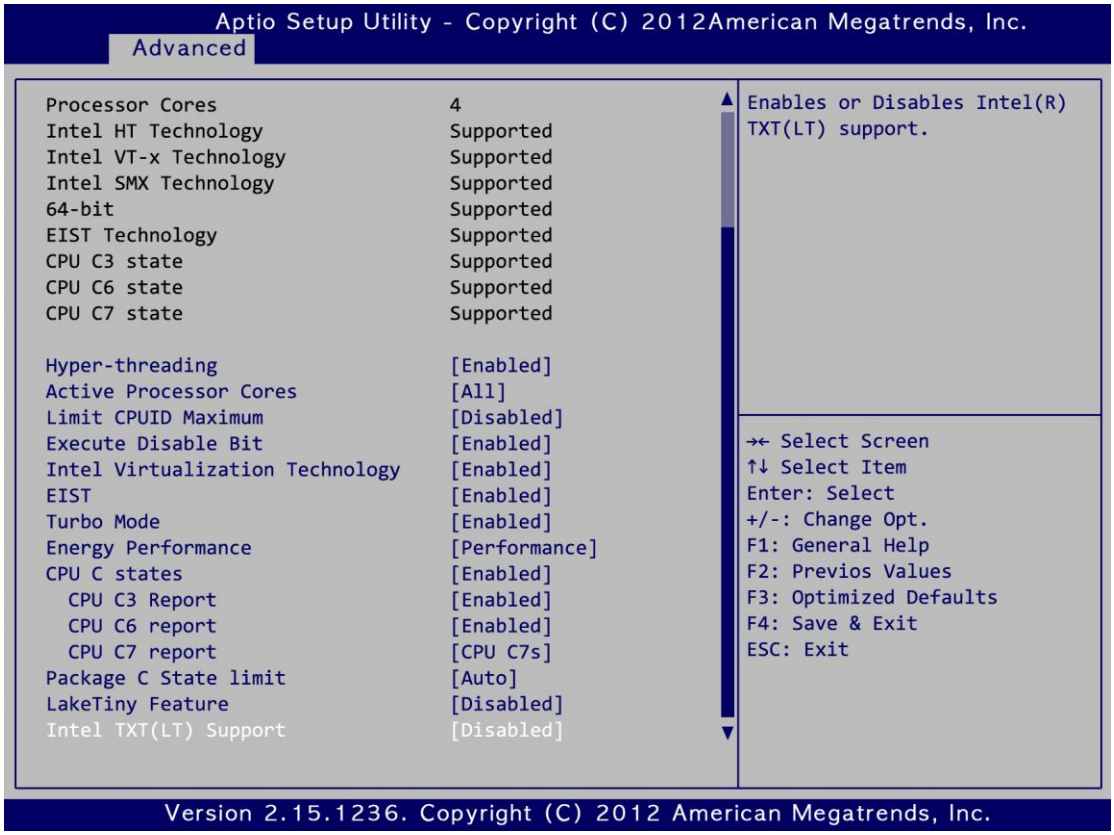
5.2.2 Trusted Computing (for CT-MHW01 only)


Aptio Setup Utility - Copyright (C) 2012 American Megatrends, Inc.
Advanced
Configuration
Security Device Support [Disabled]
Current Status Information
NO Security Device Found
Enables or Disables BIOS support for security device. O.S. will not show Security Device. TCG EFI protocol and INT1A interface will not be available.
→← Select Screen
↑↓ Select Item
Enter: Select
+/-: Change Opt.
F1: General Help
F2: Previos Values
F3: Optimized Defaults
F4: Save & Exit
ESC: Exit
Version 2.15.1236. Copyright (C) 2012 American Megatrends, Inc.

5.2.3 CPU Configuration

Enables or disables BIOS ACPI Auto Configuration.


Aptio Setup Utility - Copyright (C) 2012American Megatrends, Inc.
Advanced
CPU Configuration
Intel(R) Core(TM) i7-4770S CPU @ 3.10GHz
CPU Signature 306c3
FSB Speed 100MHz
Max CPU Speed 3100 MHz
Min CPU Speed 800 MHz
Current CPU Speed 3500 MHz
Processor Cores 4
Intel HT Technology Supported
Intel VT-x Technology Supported
Intel SMX Technology Supported
64-bit Supported
EIST Technology Supported
CPU C3 state Supported
CPU C6 state Supported
CPU C7 state Supported
Hyper-threading [Enabled]
Active Processor Cores [All]
Limit CPUID Maximum [Disabled]
Execute Disable Bit [Enabled]
Intel Virtualization Technology [Enabled]
EIST [Enabled]
Turbo Mode [Enabled]
Enabled for Windows XP and Linux (OS optimized for Hyper-Threading Technology) and Disabled for other OS (OS not optimized for Hyper-Threading Technology). When Disabled only one thread per enabled core is enabled.
→← Select Screen
↑↓ Select Item
Enter: Select
+/-: Change Opt.
F1: General Help
F2: Previos Values
F3: Optimized Defaults
F4: Save & Exit
ESC: Exit
Version 2.15.1236. Copyright (C) 2012 American Megatrends, Inc.



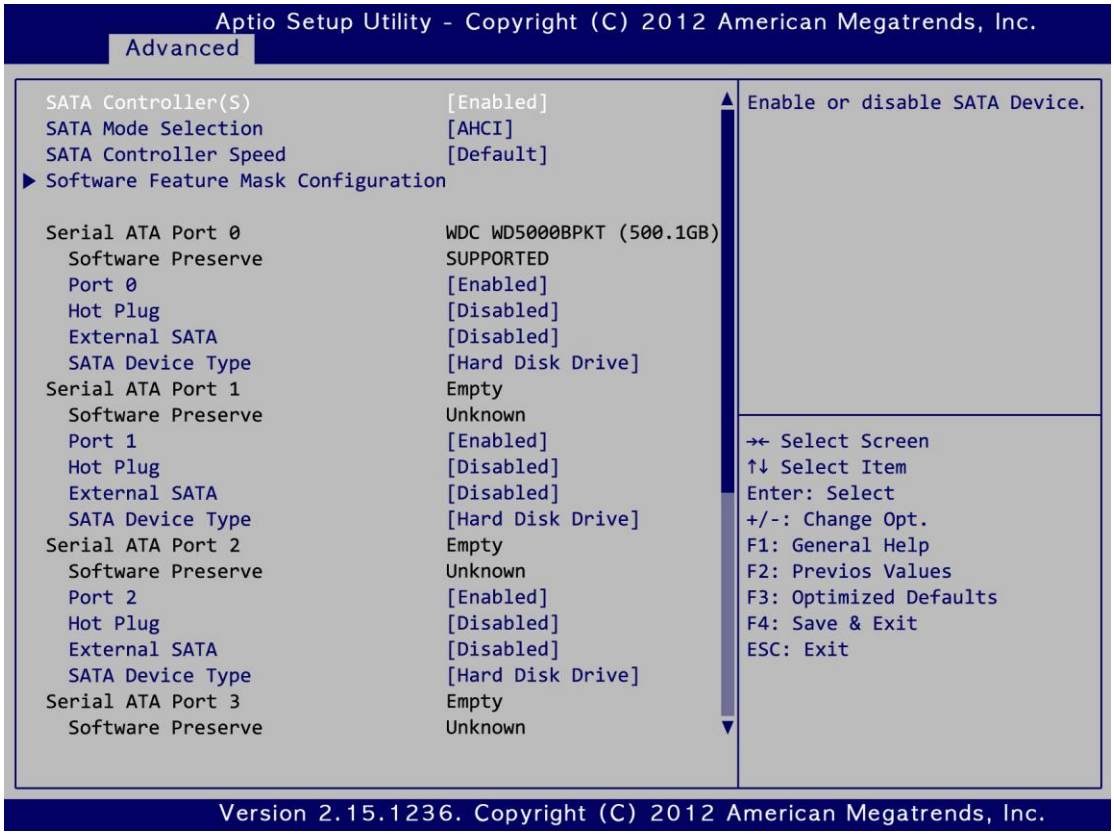
Limit CPUID Maximum: Disabled for Windows XP.

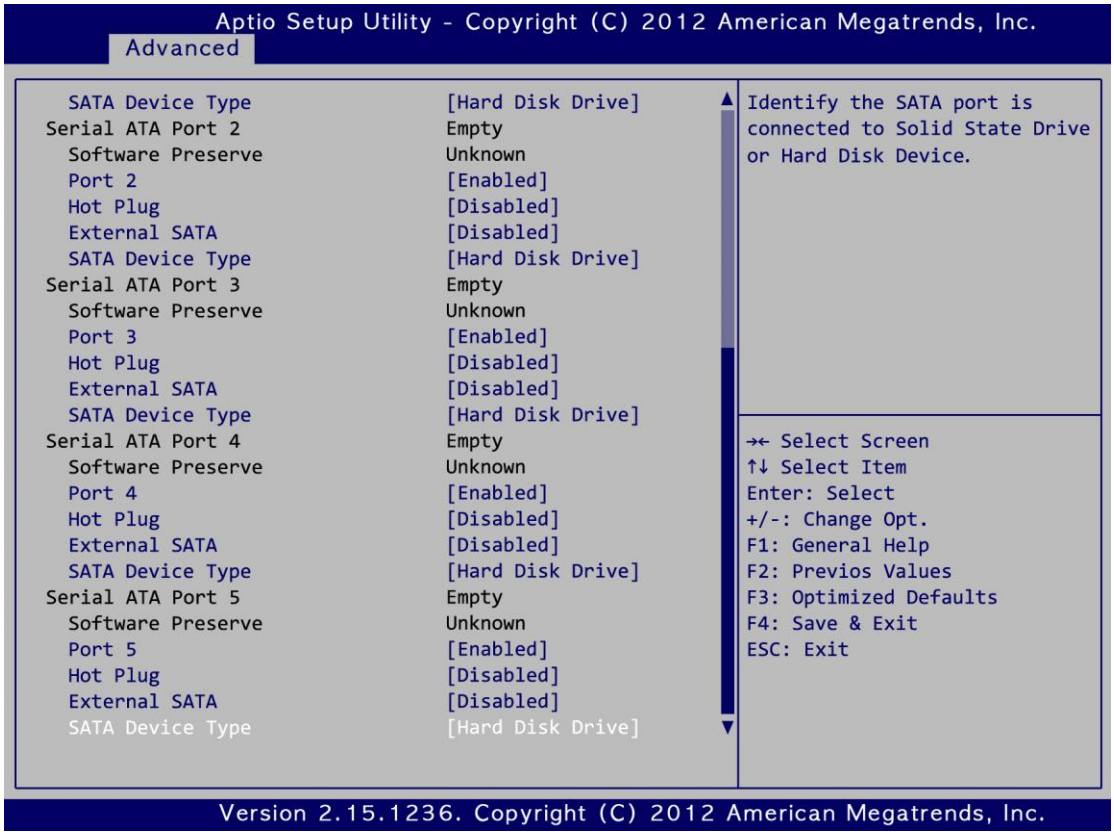
Execute Disable Bit: XP can prevent certain classes of malicious buffer overflow attacks when combined with a supporting OS (Windows Server 2003 SP1, Windows XP SP2, SusE Linux 9.2, RedHat Enterprise 3 Update 3.)

5.2.4 SATA Configuration

The BIOS automatically detects the presence of SATA device and the hardware installed in the SATA ports will be showed in the configuration. Each port can be enabled or disabled individually.

For CT-MHW01, there are six SATA Port from Serial ATA Port 0 to Serial ATA Port5.
For CT-MHW02, there are only four SATA Port from Serial ATA Port 0 to Serial ATA Port3.



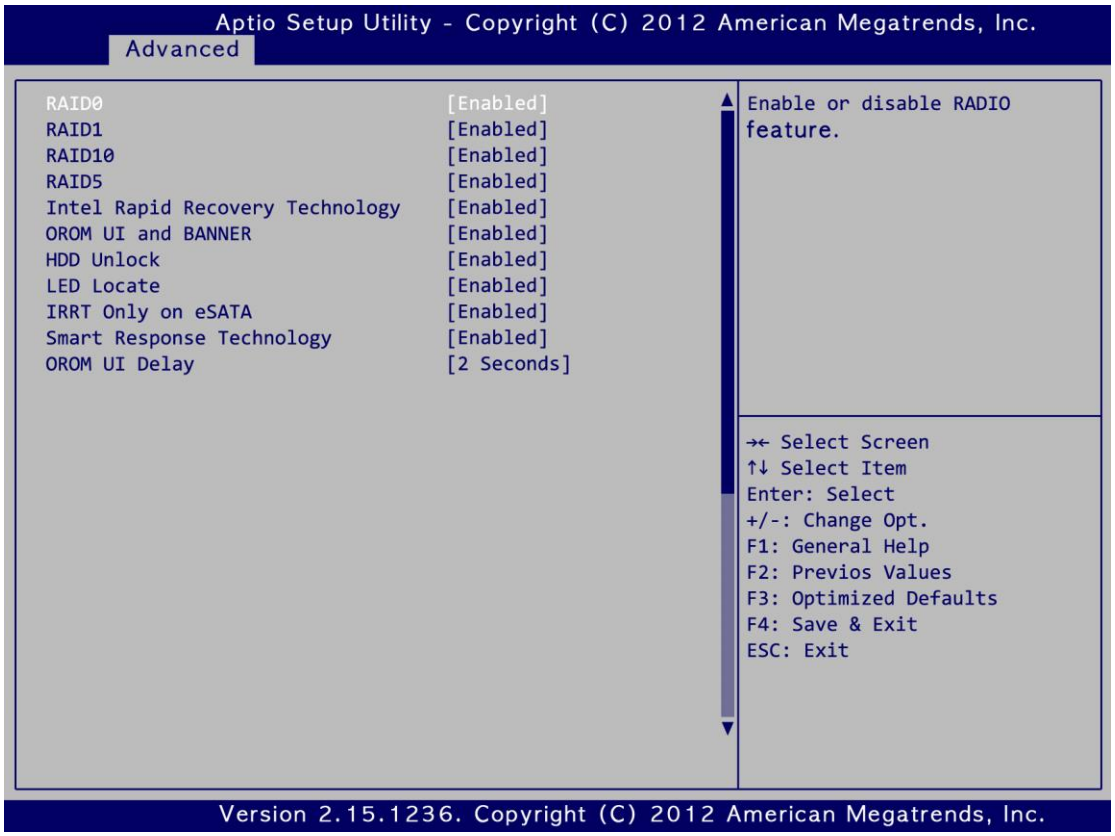

Aptio Setup Utility - Copyright (C) 2012 American Megatrends, Inc.
Advanced
SATA Device Type [Hard Disk Drive]
Serial ATA Port 2 Empty
Software Preserve Unknown
Port 2 [Enabled]
Hot Plug [Disabled]
External SATA [Disabled]
SATA Device Type [Hard Disk Drive]
Serial ATA Port 3 Empty
Software Preserve Unknown
Port 3 [Enabled]
Hot Plug [Disabled]
External SATA [Disabled]
SATA Device Type [Hard Disk Drive]
Serial ATA Port 4 Empty
Software Preserve Unknown
Port 4 [Enabled]
Hot Plug [Disabled]
External SATA [Disabled]
SATA Device Type [Hard Disk Drive]
Serial ATA Port 5 Empty
Software Preserve Unknown
Port 5 [Enabled]
Hot Plug [Disabled]
External SATA [Disabled]
SATA Device Type [Hard Disk Drive]
Identify the SATA port is connected to Solid State Drive or Hard Disk Device.
→← Select Screen
↑↓ Select Item
Enter: Select
+/-: Change Opt.
F1: General Help
F2: Previos Values
F3: Optimized Defaults
F4: Save & Exit
ESC: Exit
Version 2.15.1236. Copyright (C) 2012 American Megatrends, Inc.

SATA Mode Selection: Select the IDE, AHCI or RAID mode for SATA controller operations.

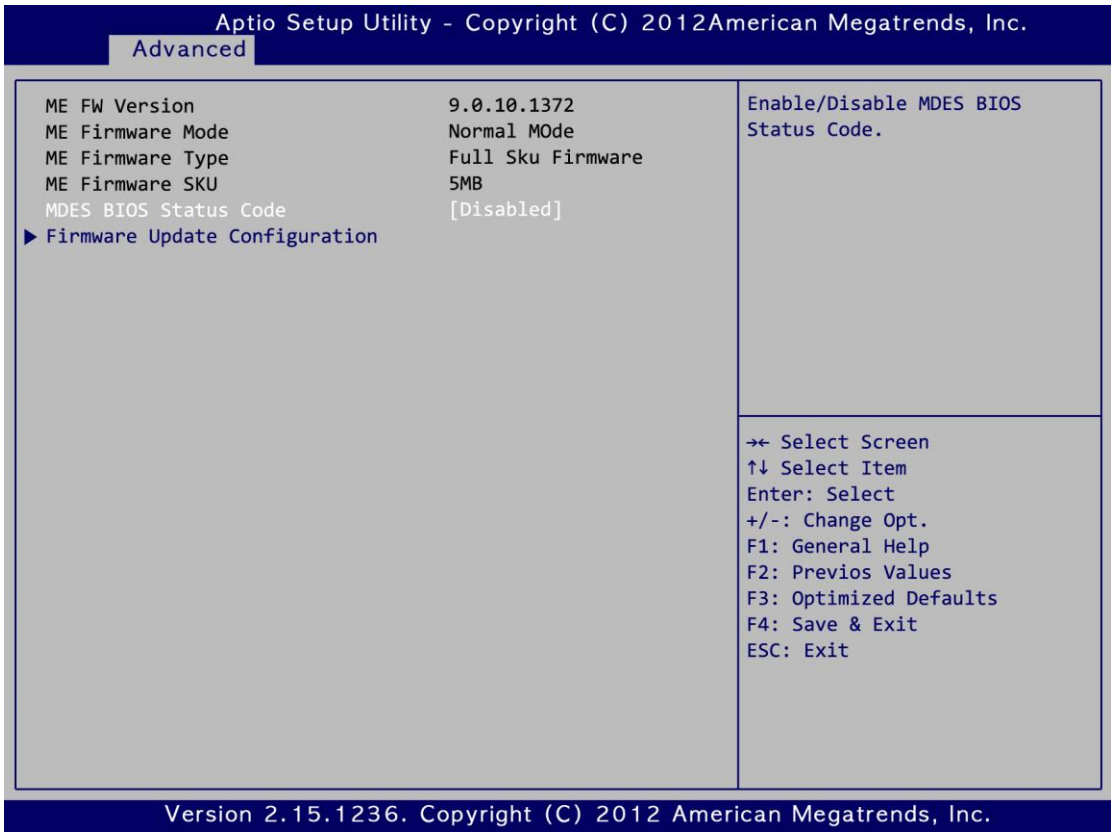
Hot Plug: Designates this port as Hot Pluggable.

SATA Device Type: Identify the SATA port is connected to Solid State Drive or Hard Disk Drive.

5.2.4.1 Software Feature Mask Configuration



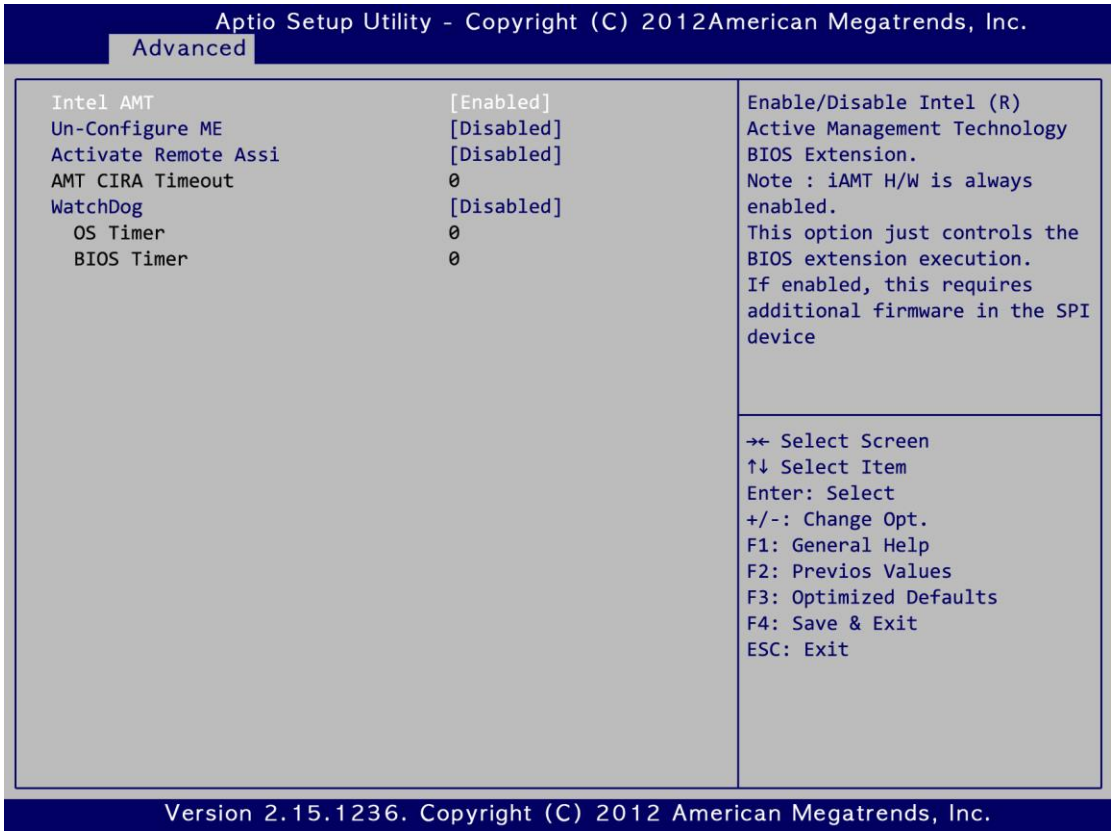
5.2.5 PCH-FW Configuration


Aptio Setup Utility - Copyright (C) 2012American Megatrends, Inc.
Advanced
ME FW Version 9.0.10.1372
ME Firmware Mode Normal MOde
ME Firmware Type Full Sku Firmware
ME Firmware SKU 5MB
MDES BIOS Status Code [Disabled]
▶ Firmware Update Configuration
Enable/Disable MDES BIOS Status Code.
→← Select Screen
↑↓ Select Item
Enter: Select
+/-: Change Opt.
F1: General Help
F2: Previos Values
F3: Optimized Defaults
F4: Save & Exit
ESC: Exit
Version 2.15.1236. Copyright (C) 2012 American Megatrends, Inc.

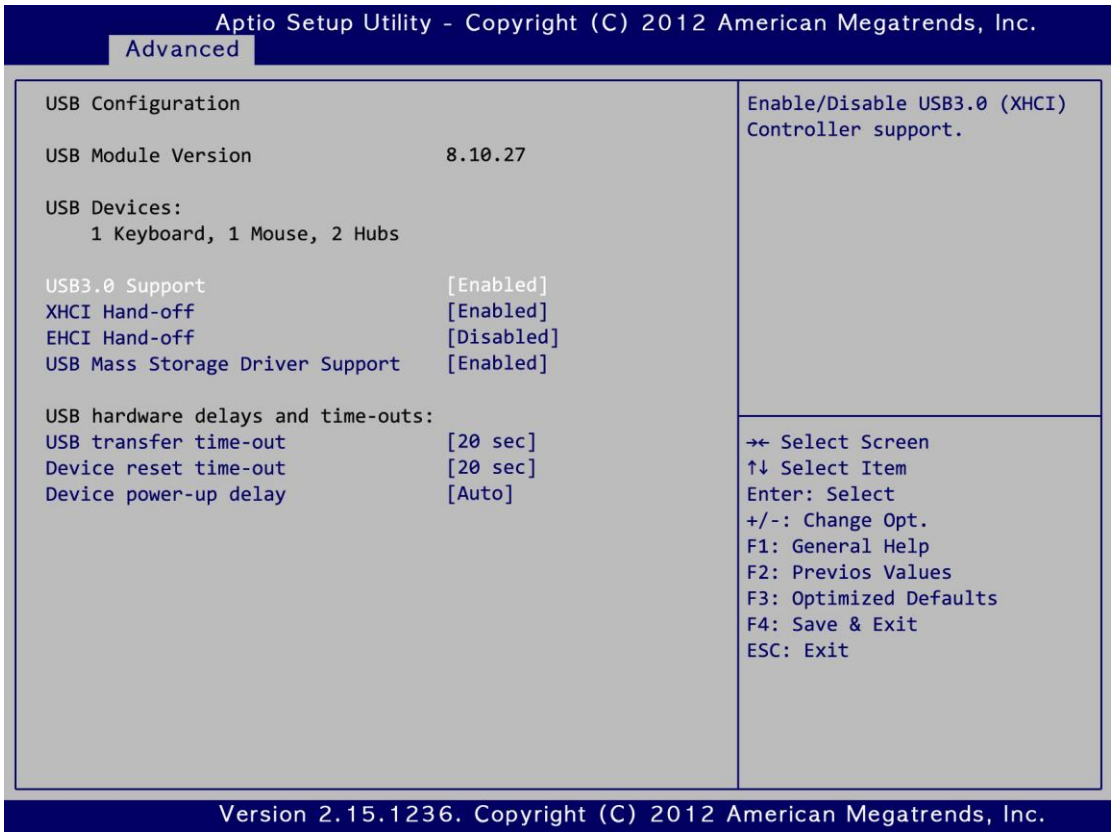
Firmware Update Configuration: Enable/Disable Me FW Image Re-Flash function.

5.2.6 AMT Configuration (for CT-MHW01 only)

Enable or disable Intel® Active Management Technology BIOS Extension.
Note: iAMT H/W is always enabled.
This option just controls the BIOS extension execution. If enabled, this requires additional firmware in the SPI device.

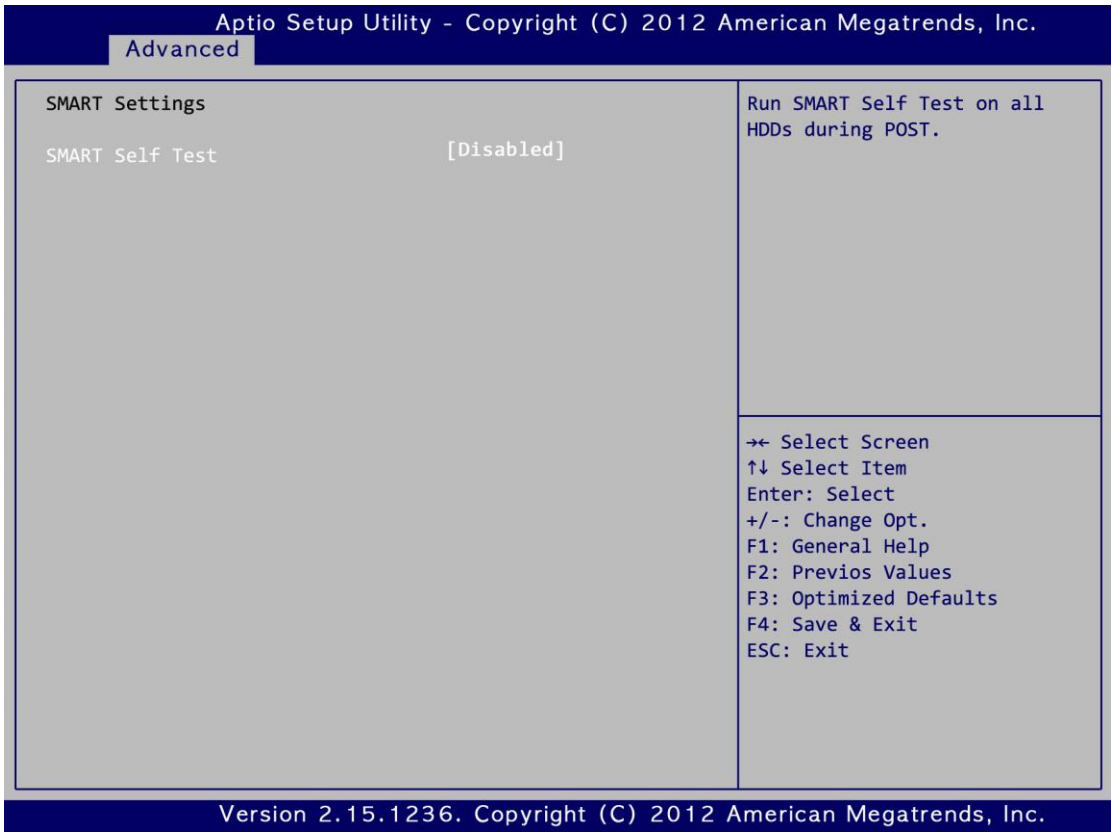

Aptio Setup Utility - Copyright (C) 2012American Megatrends, Inc.
Advanced
Intel AMT [Enabled]
Un-Configure ME [Disabled]
Activate Remote Assi [Disabled]
AMT CIRA Timeout 0
WatchDog [Disabled]
OS Timer 0
BIOS Timer 0
Enable/Disable Intel (R) Active Management Technology BIOS Extension.
Note : iAMT H/W is always enabled.
This option just controls the BIOS extension execution.
If enabled, this requires additional firmware in the SPI device
→← Select Screen
↑↓ Select Item
Enter: Select
+/-: Change Opt.
F1: General Help
F2: Previos Values
F3: Optimized Defaults
F4: Save & Exit
ESC: Exit
Version 2.15.1236. Copyright (C) 2012 American Megatrends, Inc.

5.2.7 USB Configuration

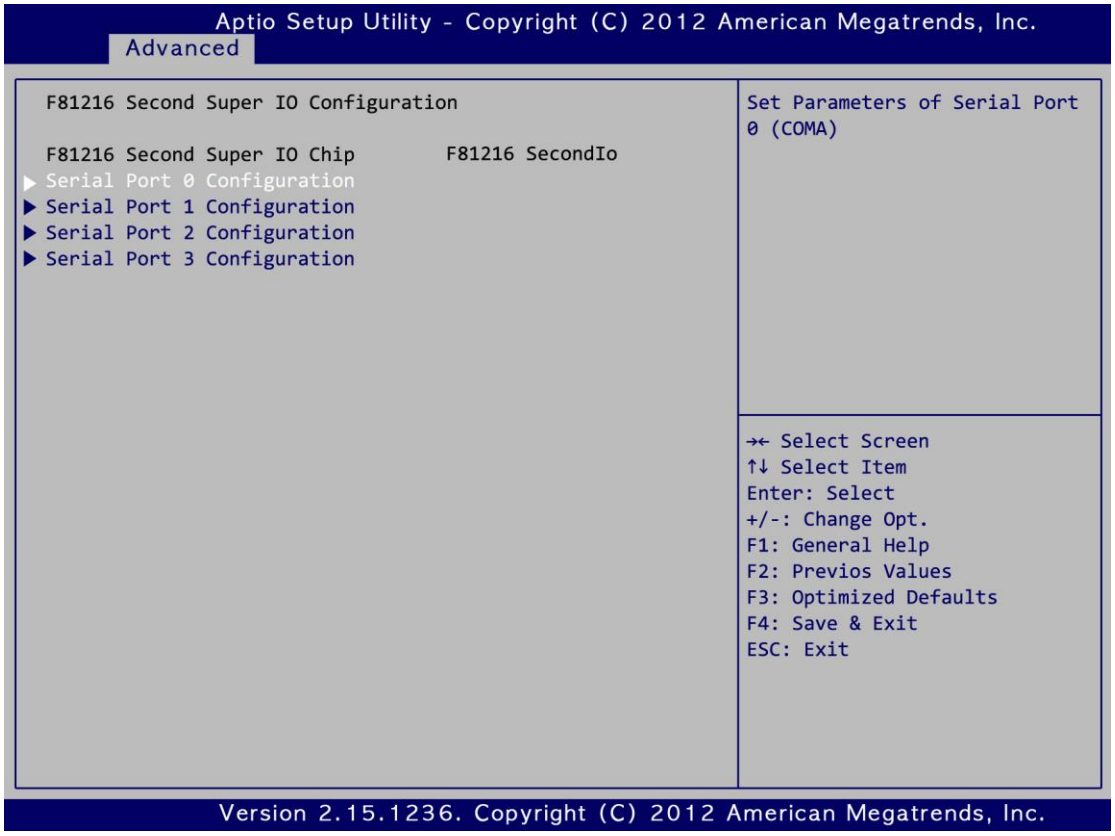


EHCI Hand-off: This is a workaround for OSes without EHCI hand-off support. The EHCI ownership change should be claimed by EHCI driver.

5.2.8 SMART Settings



5.2.9 F81216 Second Super IO Configuration (for CT-MHW02 only)


Aptio Setup Utility - Copyright (C) 2012 American Megatrends, Inc.
Advanced
F81216 Second Super IO Configuration
F81216 Second Super IO Chip F81216 SecondIo
Serial Port 0 Configuration
Serial Port 1 Configuration
Serial Port 2 Configuration
Serial Port 3 Configuration
Set Parameters of Serial Port 0 (COMA)
→← Select Screen
↑↓ Select Item
Enter: Select
+/-: Change Opt.
F1: General Help
F2: Previos Values
F3: Optimized Defaults
F4: Save & Exit
ESC: Exit
Version 2.15.1236. Copyright (C) 2012 American Megatrends, Inc.

Each Serial Port can be enabled or disabled individually.

The device setting for these four serial ports are as following:

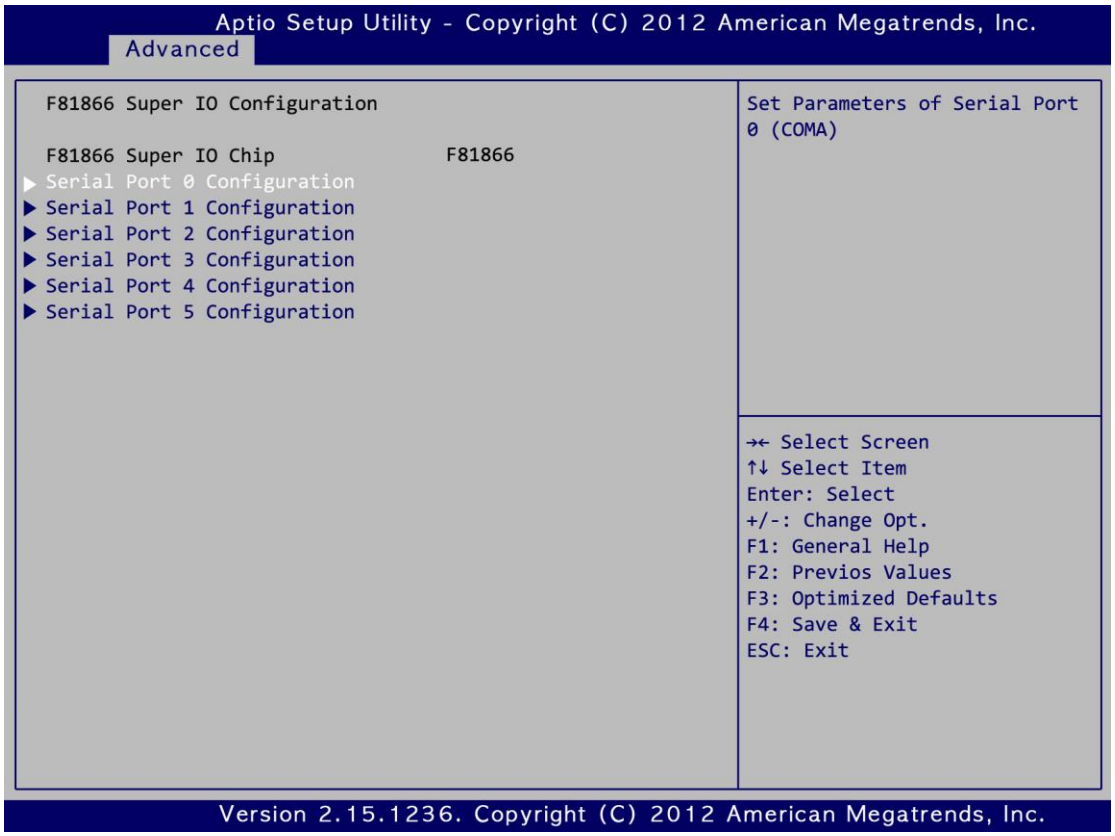
Serial Port 0: IO=260h; IRQ=5;

Serial Port 1: IO=268h; IRQ=5;

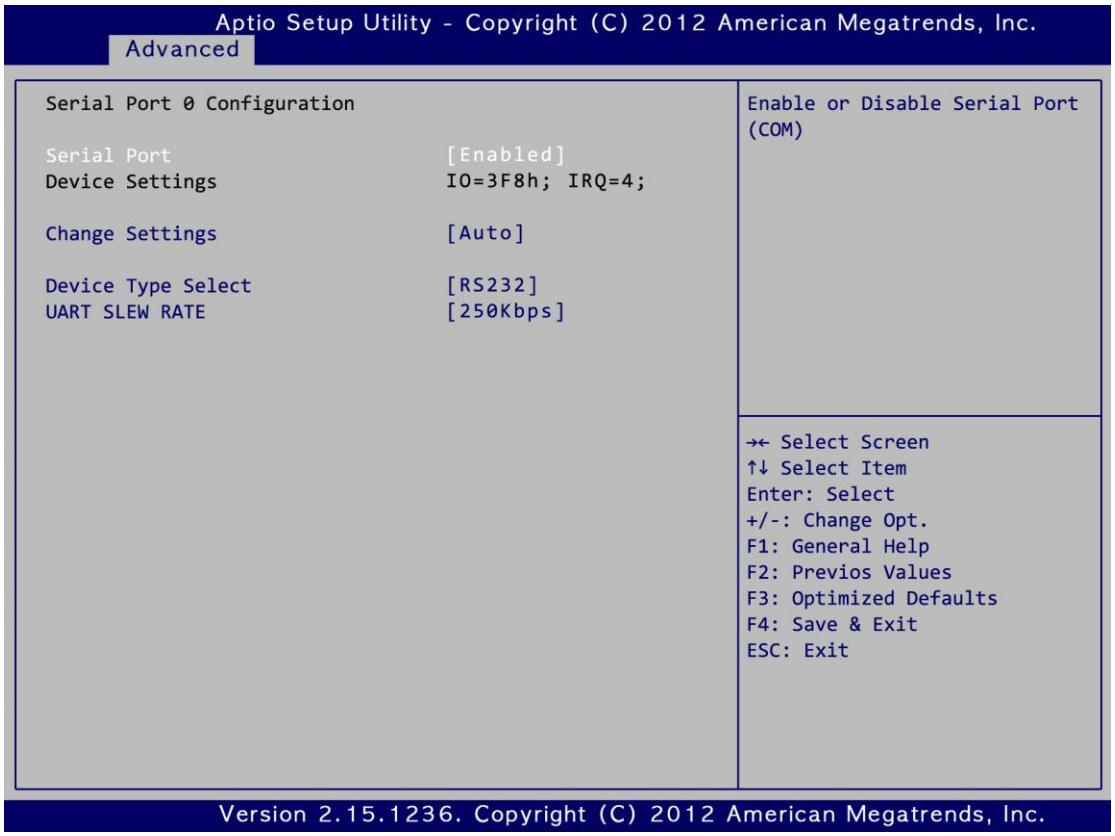
Serial Port 2: IO=270h; IRQ=5;

Serial Port 3: IO=278h; IRQ=5.

5.2.10 F81866 Super IO Configuration


Aptio Setup Utility - Copyright (C) 2012 American Megatrends, Inc.
Advanced
F81866 Super IO Configuration
F81866 Super IO Chip F81866
Serial Port 0 Configuration
Serial Port 1 Configuration
Serial Port 2 Configuration
Serial Port 3 Configuration
Serial Port 4 Configuration
Serial Port 5 Configuration
Set Parameters of Serial Port 0 (COMA)
→← Select Screen
↑↓ Select Item
Enter: Select
+/-: Change Opt.
F1: General Help
F2: Previos Values
F3: Optimized Defaults
F4: Save & Exit
ESC: Exit
Version 2.15.1236. Copyright (C) 2012 American Megatrends, Inc.

5.2.8.1 Serial Port Configuration



Each Serial Port can be enabled or disabled individually.

The device setting for these four serial ports are as following:

Serial Port 0: IO=3F8h; IRQ=4;

Serial Port 1: IO=2F8h; IRQ=3;

Serial Port 2: IO=3E8h; IRQ=7;

Serial Port 3: IO=2E8h; IRQ=6;

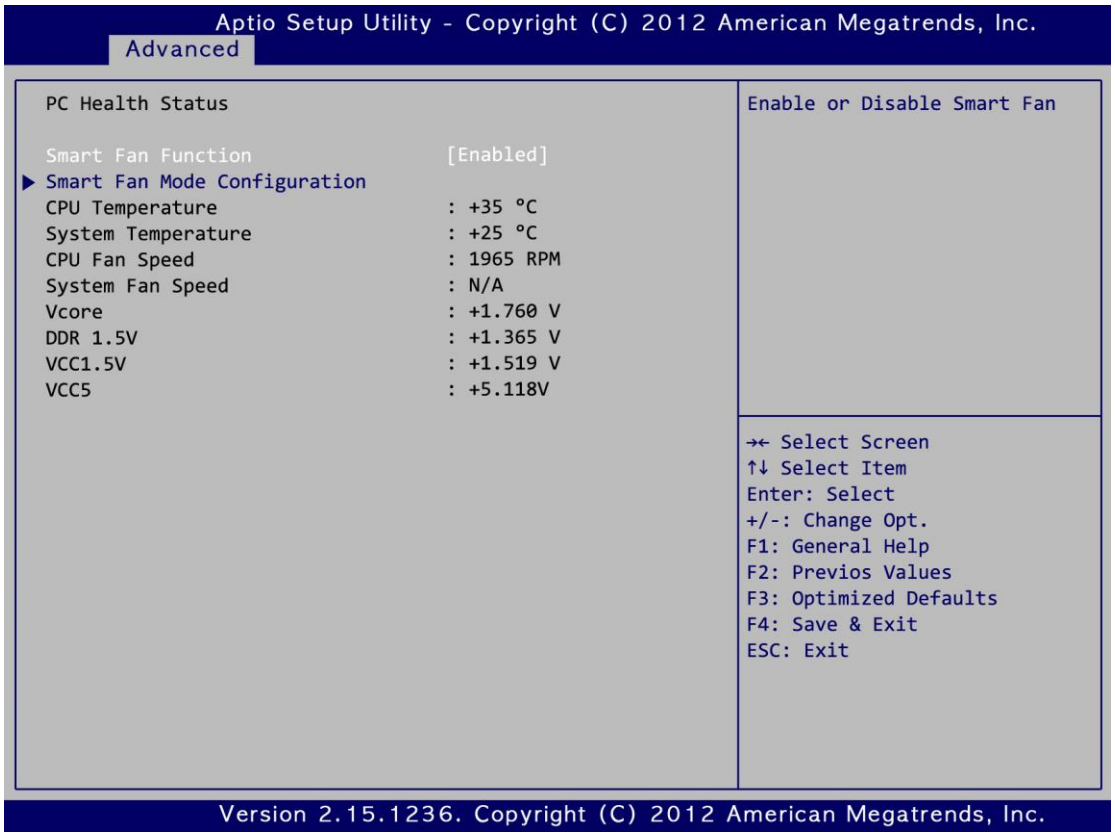
Serial Port 4: IO=238h; IRQ=11 for CT-MHW01;

Serial Port 4: IO=238h; IRQ=10 for CT-MHW02;

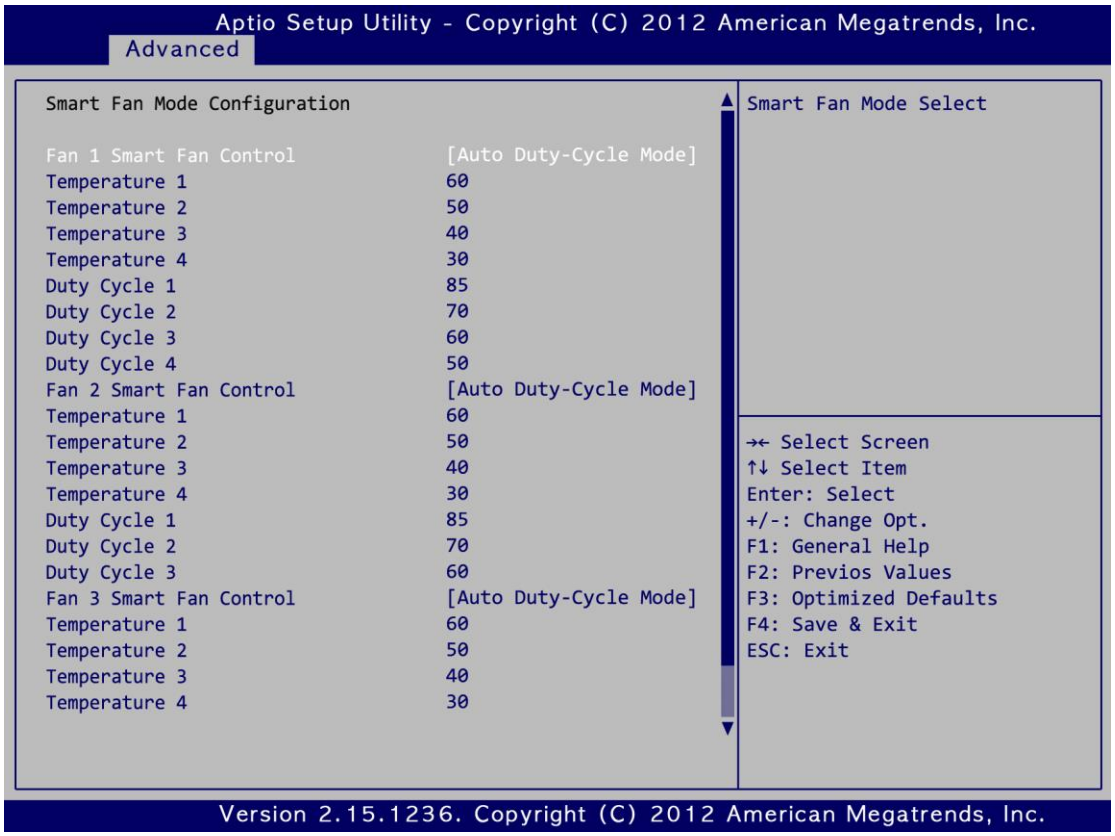
Serial Port 5: IO=228h; IRQ=10.

Only Serial Port 0 and Serial Port 1 can select device type.

5.2.11 F81866 Hardware Monitor

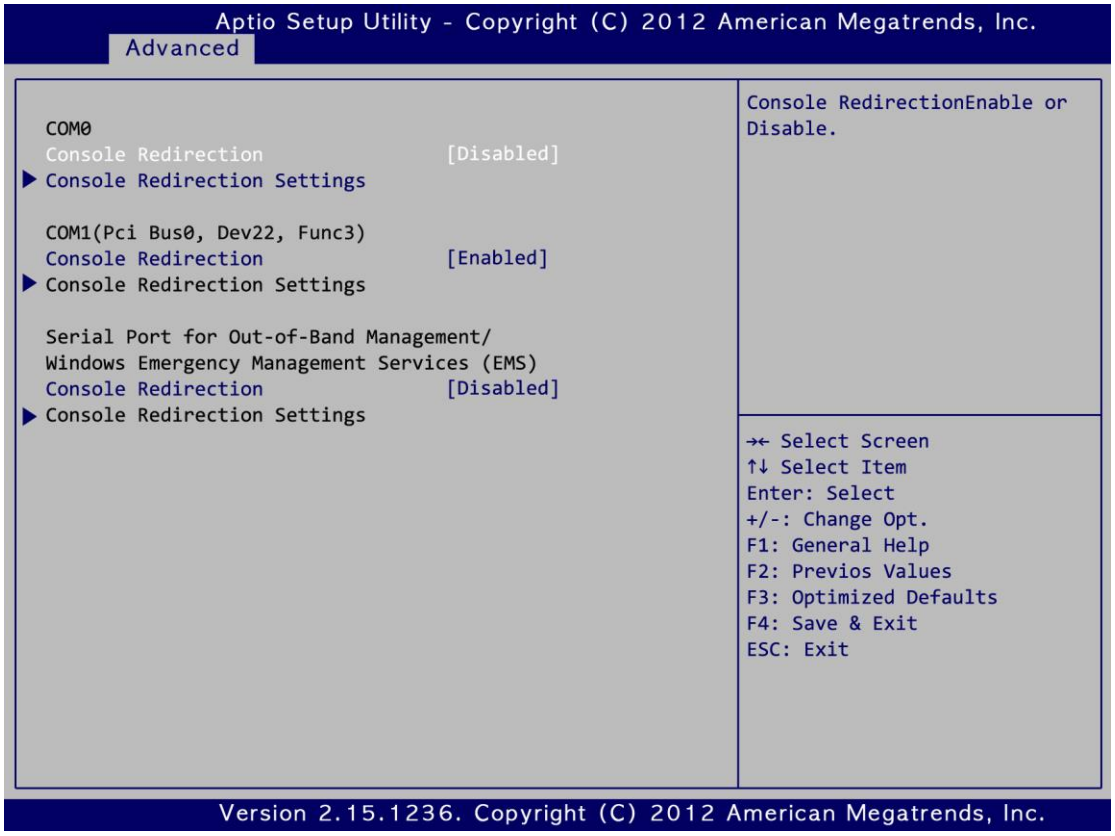

Aptio Setup Utility - Copyright (C) 2012 American Megatrends, Inc.
Advanced
PC Health Status
Smart Fan Function [Enabled]
Smart Fan Mode Configuration
CPU Temperature : +35 °C
System Temperature : +25 °C
CPU Fan Speed : 1965 RPM
System Fan Speed : N/A
Vcore : +1.760 V
DDR 1.5V : +1.365 V
VCC1.5V : +1.519 V
VCC5 : +5.118V
Enable or Disable Smart Fan
→← Select Screen
↑↓ Select Item
Enter: Select
+/-: Change Opt.
F1: General Help
F2: Previos Values
F3: Optimized Defaults
F4: Save & Exit
ESC: Exit
Version 2.15.1236. Copyright (C) 2012 American Megatrends, Inc.

5.2.9.1 Smart Fan Mode Configuration

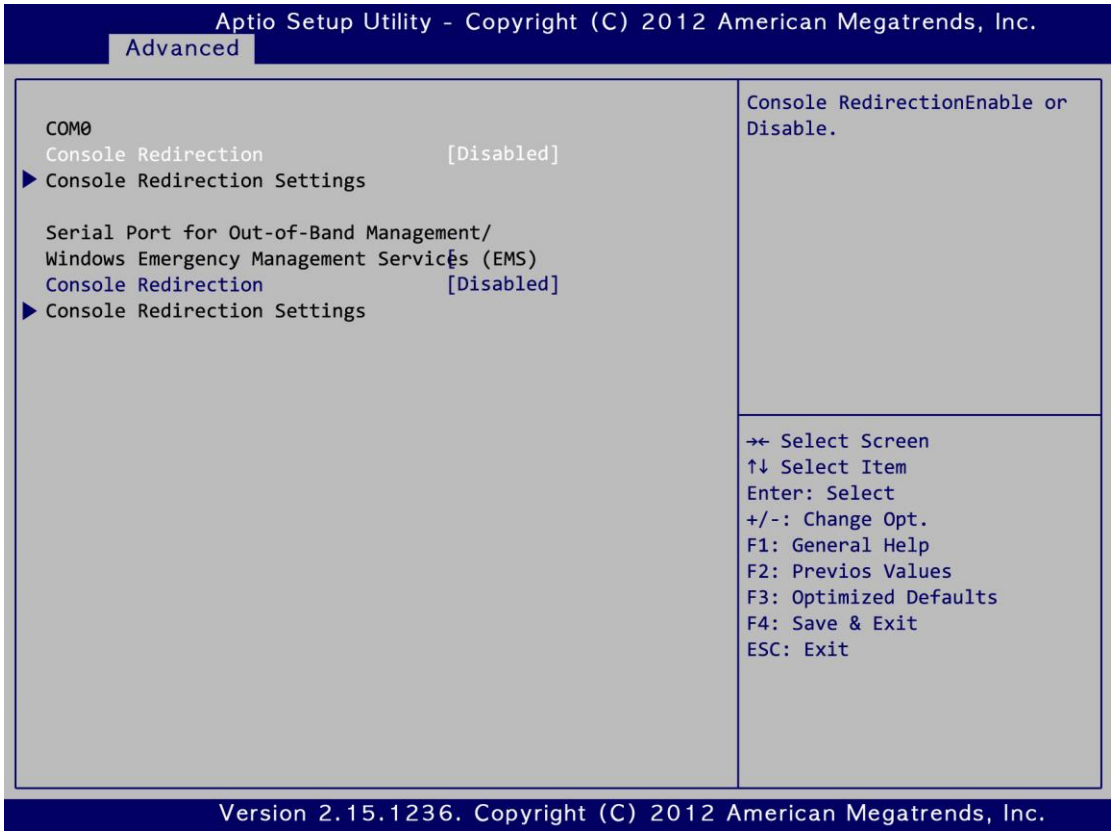


5.2.12 Serial Port Console Redirection

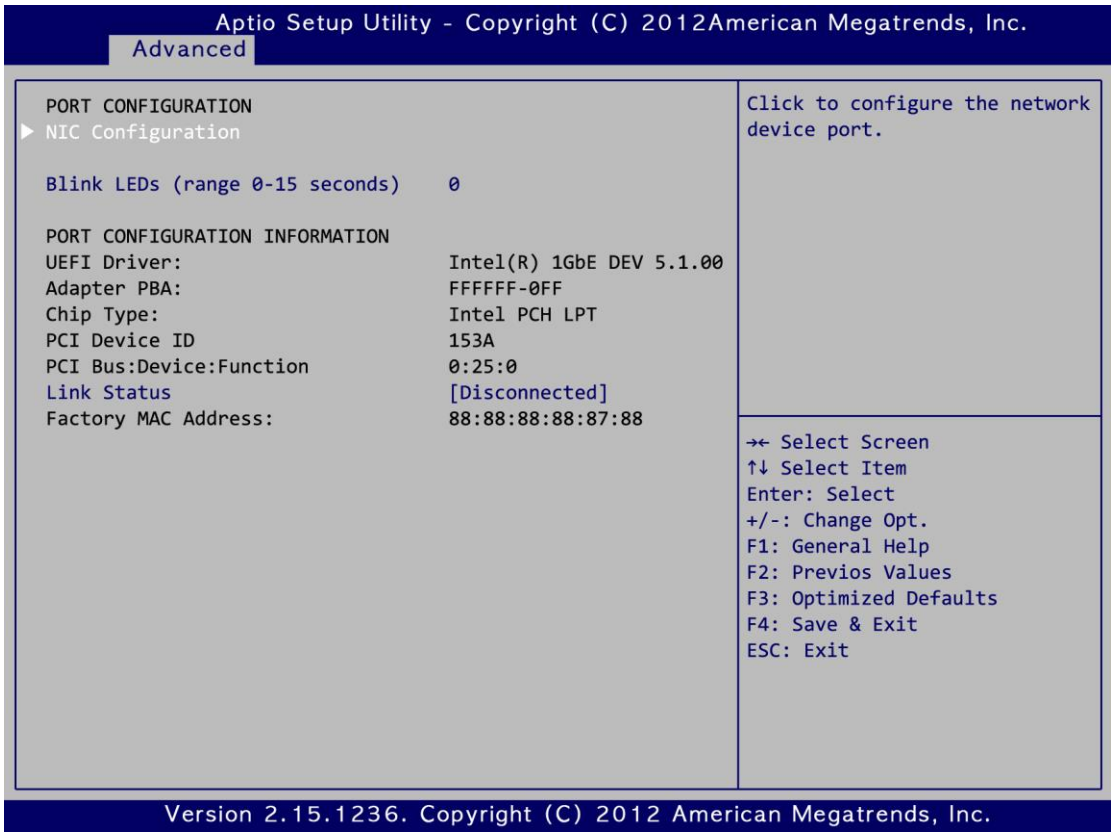
- CT-MHW01



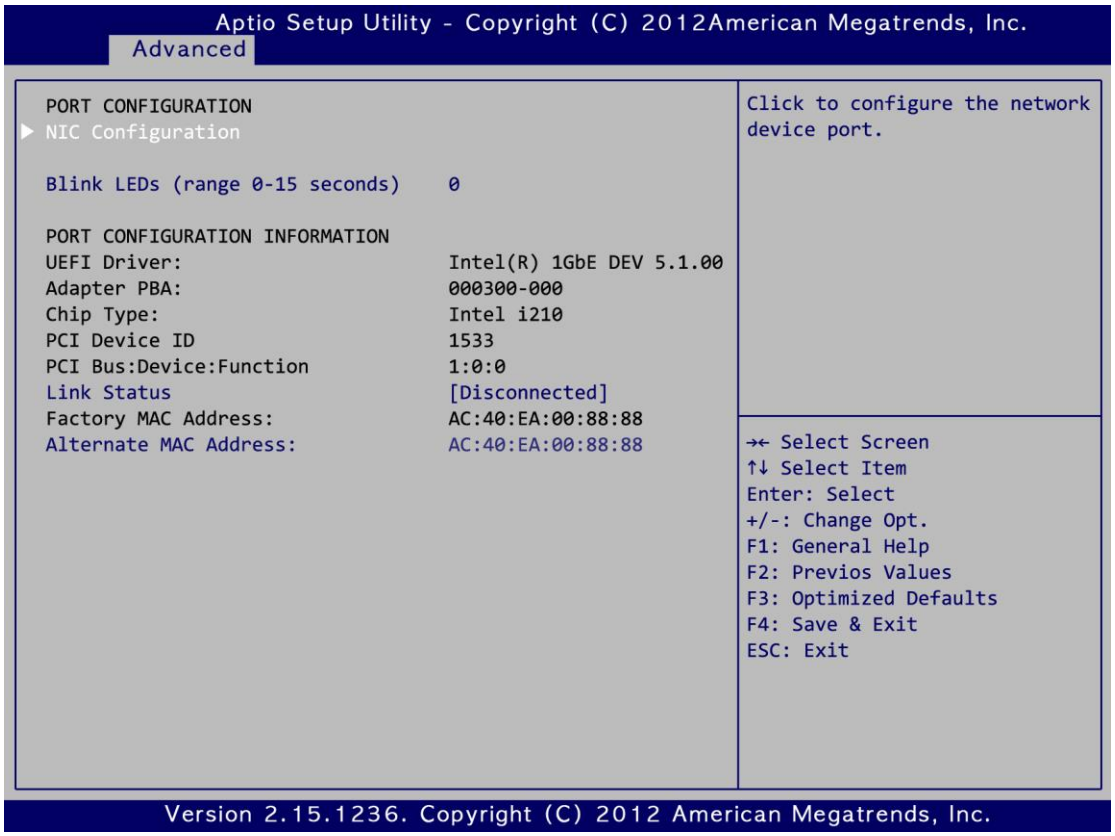
- CT-MHW02


Aptio Setup Utility - Copyright (C) 2012 American Megatrends, Inc.
Advanced
COM0
Console Redirection [Disabled]
Console Redirection Settings
Serial Port for Out-of-Band Management/
Windows Emergency Management Services (EMS)
Console Redirection [Disabled]
Console Redirection Settings
Console RedirectionEnable or Disable.
→← Select Screen
↑↓ Select Item
Enter: Select
+/-: Change Opt.
F1: General Help
F2: Previos Values
F3: Optimized Defaults
F4: Save & Exit
ESC: Exit
Version 2.15.1236. Copyright (C) 2012 American Megatrends, Inc.

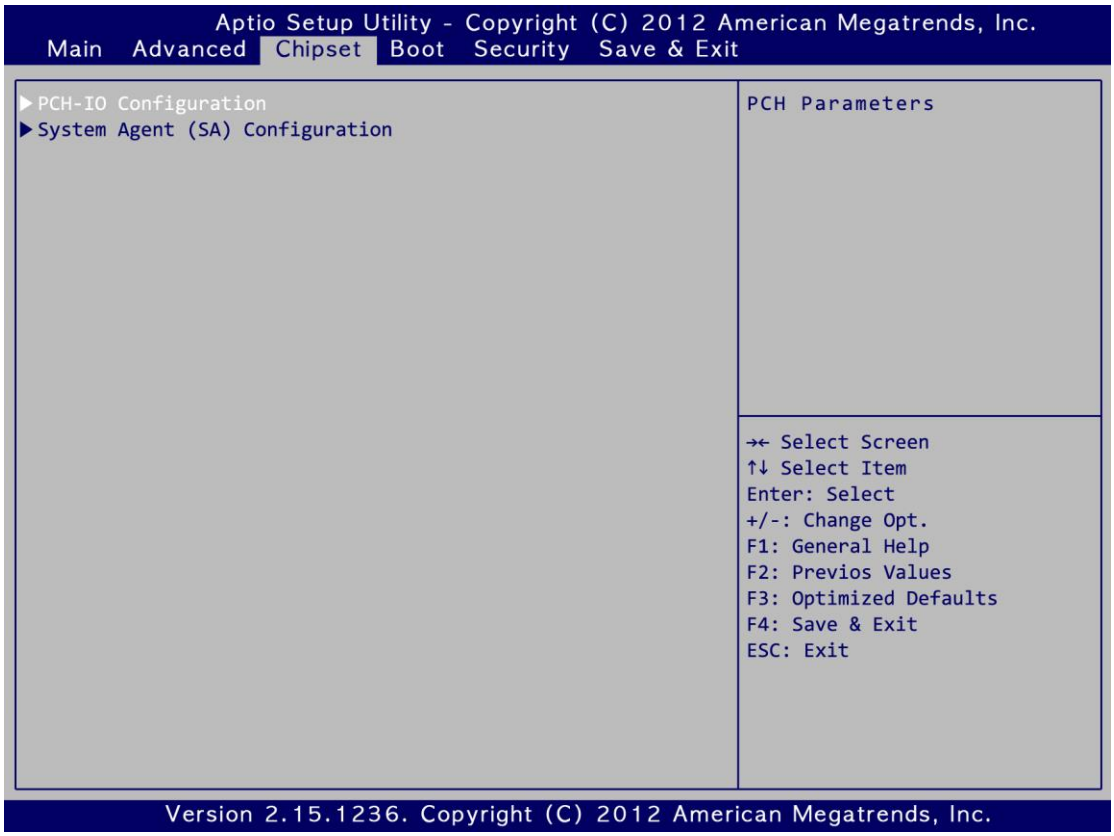
5.2.13 Intel(R) Ethernet Network Connection i217-LM



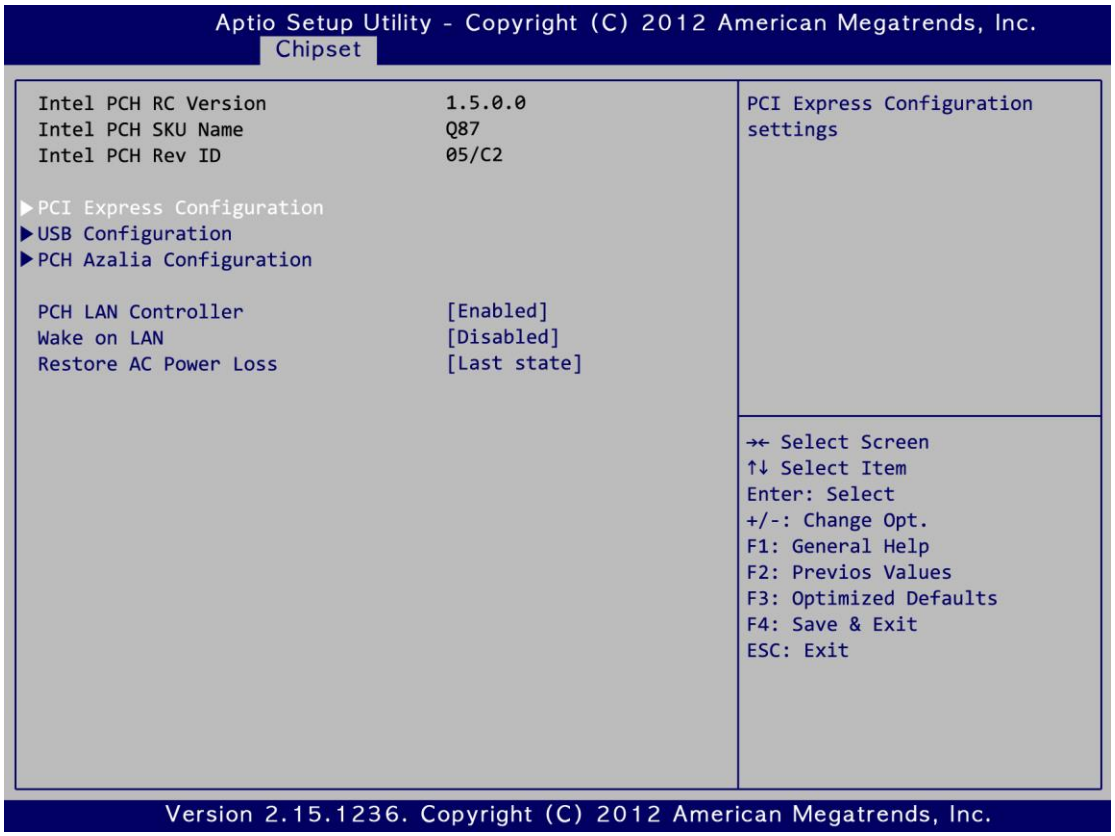
5.2.14 Intel(R) I210 Gigabit Network Connection



5.3 Chipset


Aptio Setup Utility - Copyright (C) 2012 American Megatrends, Inc.
Main Advanced Chipset Boot Security Save & Exit
PCH-IO Configuration
System Agent (SA) Configuration
PCH Parameters
→← Select Screen
↑↓ Select Item
Enter: Select
+/-: Change Opt.
F1: General Help
F2: Previos Values
F3: Optimized Defaults
F4: Save & Exit
ESC: Exit
Version 2.15.1236. Copyright (C) 2012 American Megatrends, Inc.

5.3.1 PCH-IO Configuration



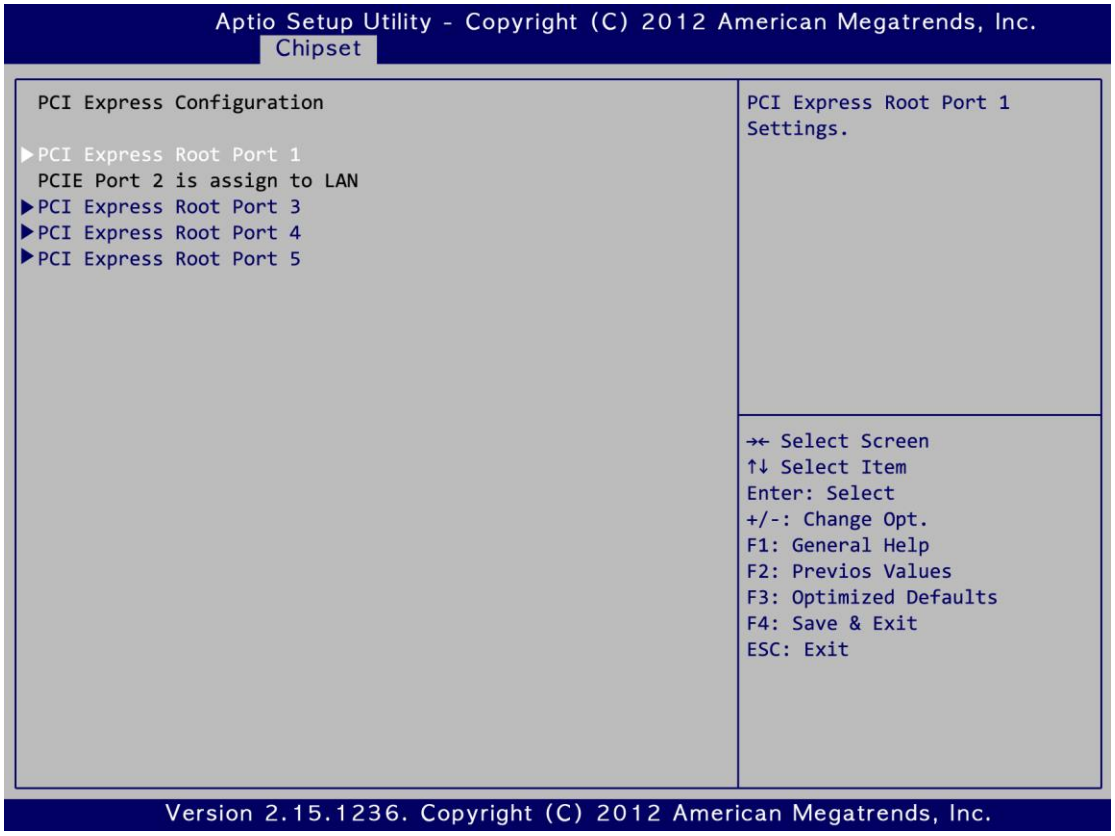
Intel PCH SKU Name:

Q87 is showed for CT-MHW01 model

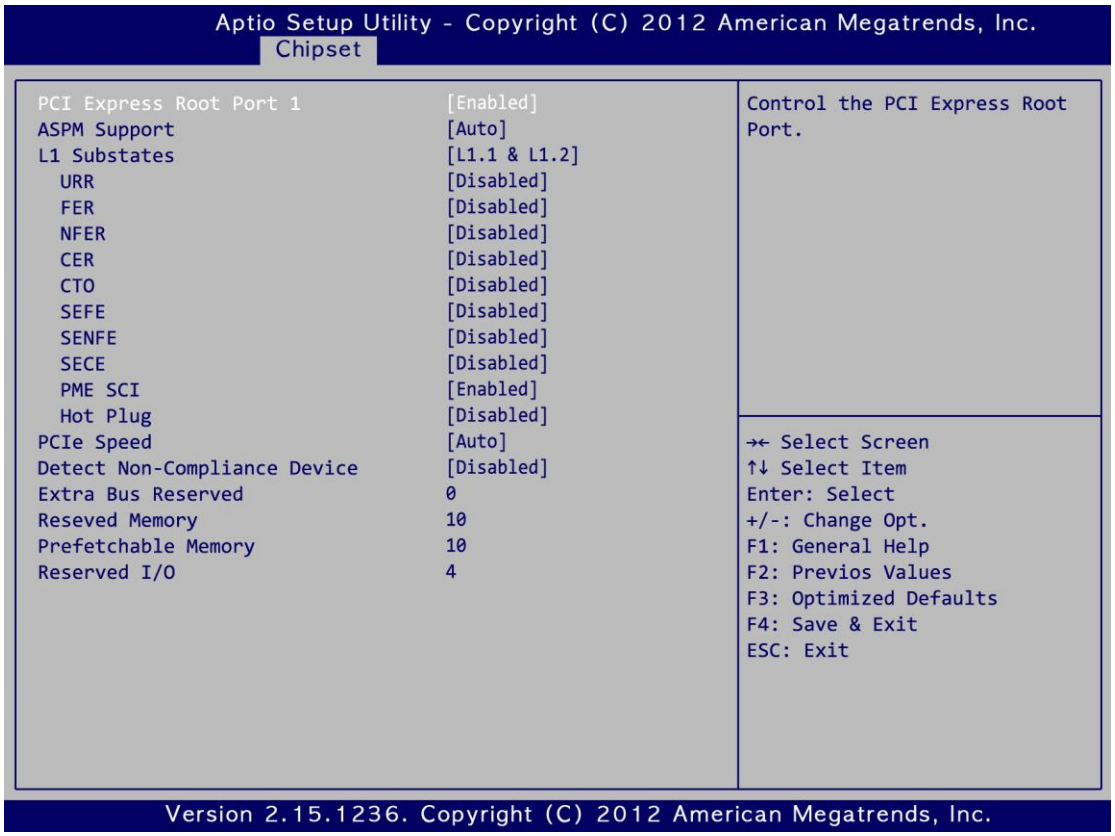
H81 is showed for CT-MHW02 model

5.3.1.1 PCI Express Configuration

Each PCI Express Port from 1 to 5 can be setup except Port 2, which is assigned to LAN.


Aptio Setup Utility - Copyright (C) 2012 American Megatrends, Inc.
Chipset
PCI Express Configuration
PCI Express Root Port 1
PCIE Port 2 is assign to LAN
PCI Express Root Port 3
PCI Express Root Port 4
PCI Express Root Port 5
PCI Express Root Port 1 Settings.
→← Select Screen
↑↓ Select Item
Enter: Select
+/-: Change Opt.
F1: General Help
F2: Previos Values
F3: Optimized Defaults
F4: Save & Exit
ESC: Exit
Version 2.15.1236. Copyright (C) 2012 American Megatrends, Inc.

5.3.1.1.1 PCI Express Root Port



Each PCI Express Root Port can be enabled or disabled individually.

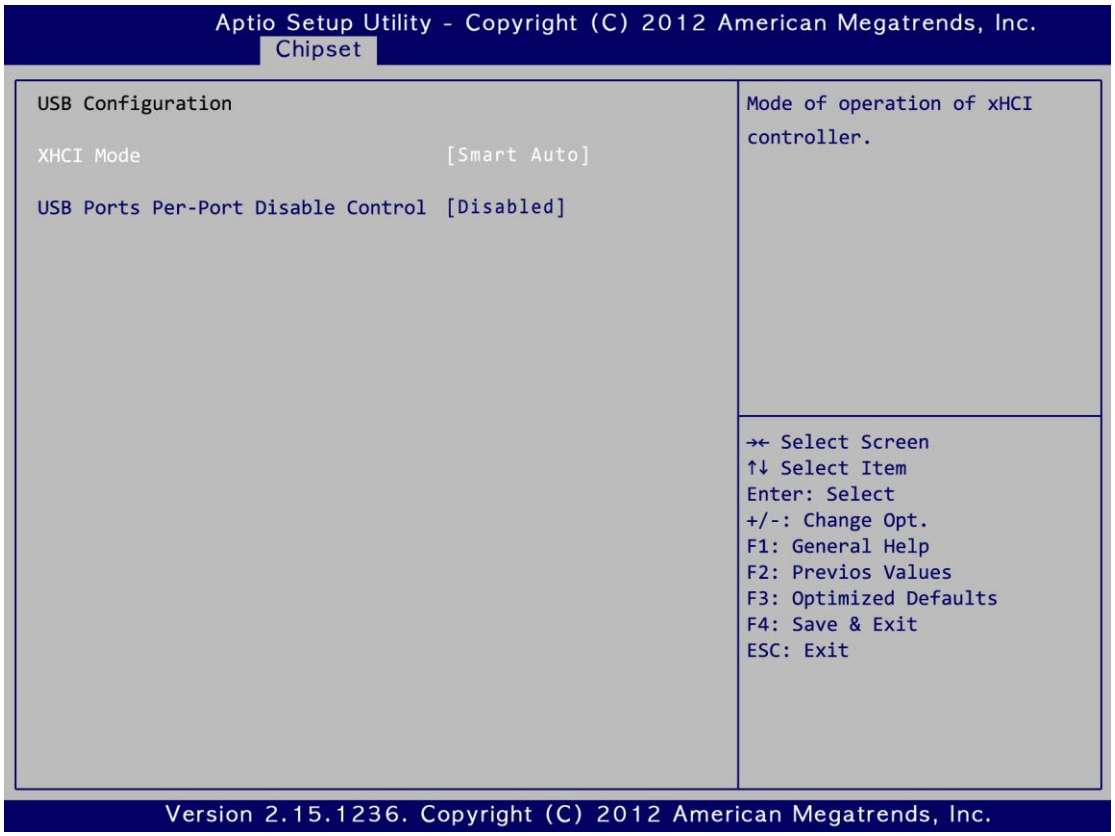
ASPM: Set the ASPM level

Force L0s – Force all links to L0s State

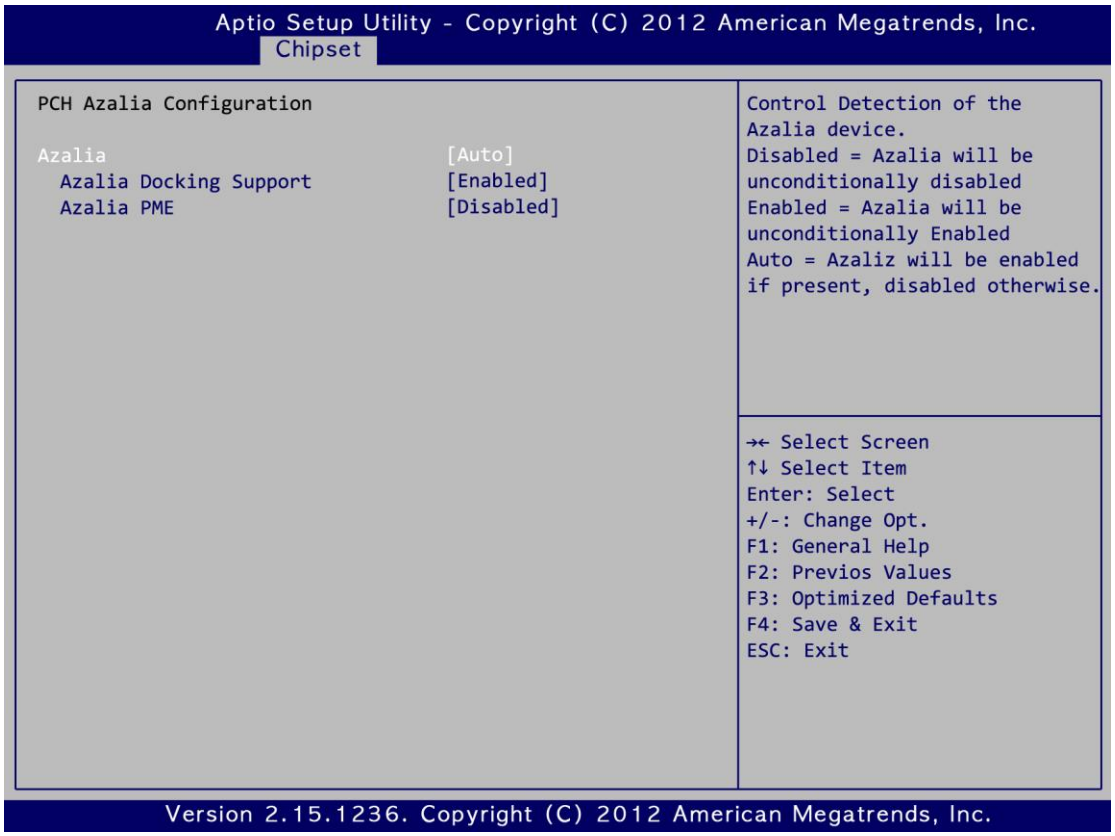
AUTO – BIO auto configure

DISABLE – Disables ASPM

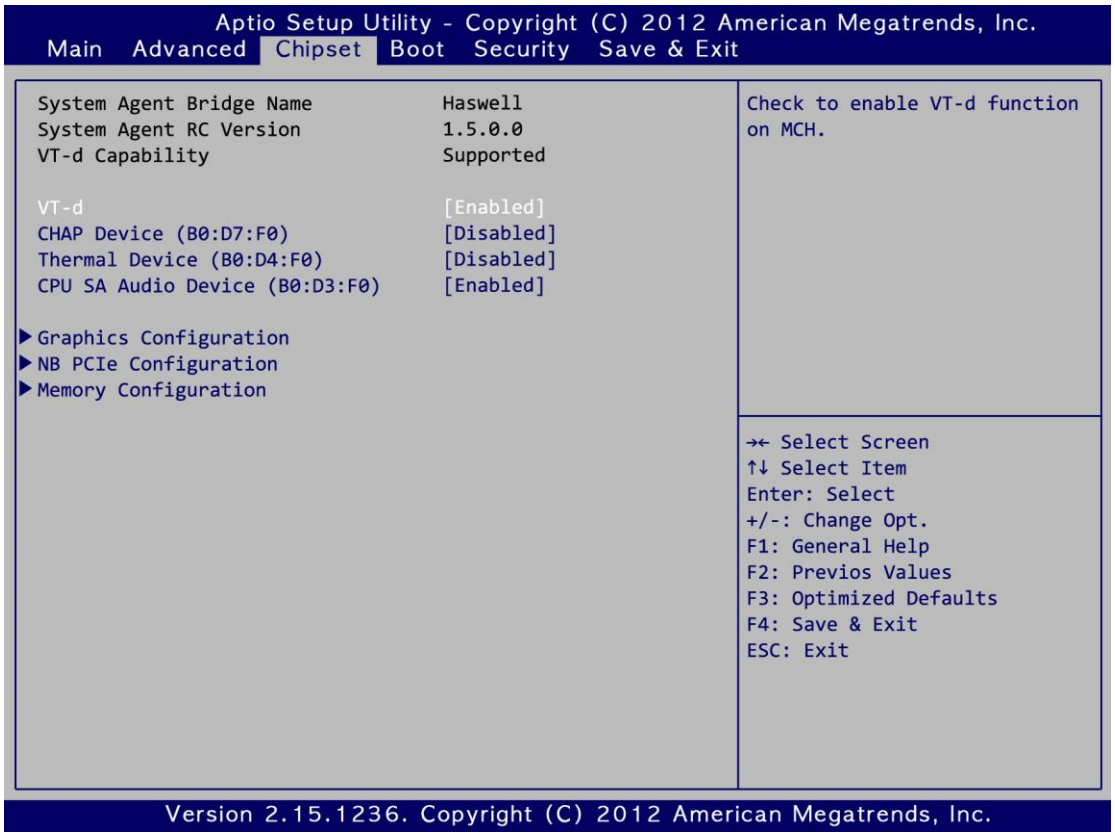
5.3.1.2 USB Configuration



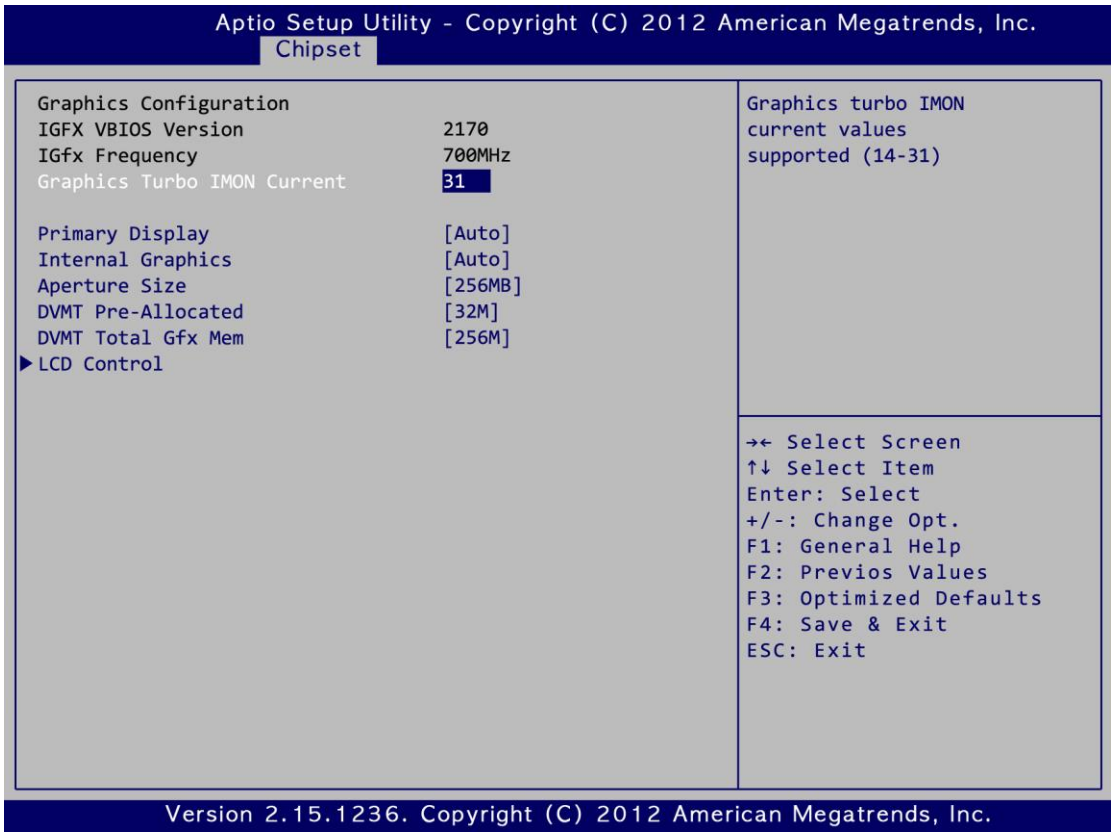
5.3.1.3 PCH Azalia Configuration


Aptio Setup Utility - Copyright (C) 2012 American Megatrends, Inc.
Chipset
PCH Azalia Configuration
Azalia [Auto]
Azalia Docking Support [Enabled]
Azalia PME [Disabled]
Control Detection of the Azalia device.
Disabled = Azalia will be unconditionally disabled
Enabled = Azalia will be unconditionally Enabled
Auto = Azaliz will be enabled if present, disabled otherwise.
→← Select Screen
↑↓ Select Item
Enter: Select
+/-: Change Opt.
F1: General Help
F2: Previos Values
F3: Optimized Defaults
F4: Save & Exit
ESC: Exit
Version 2.15.1236. Copyright (C) 2012 American Megatrends, Inc.

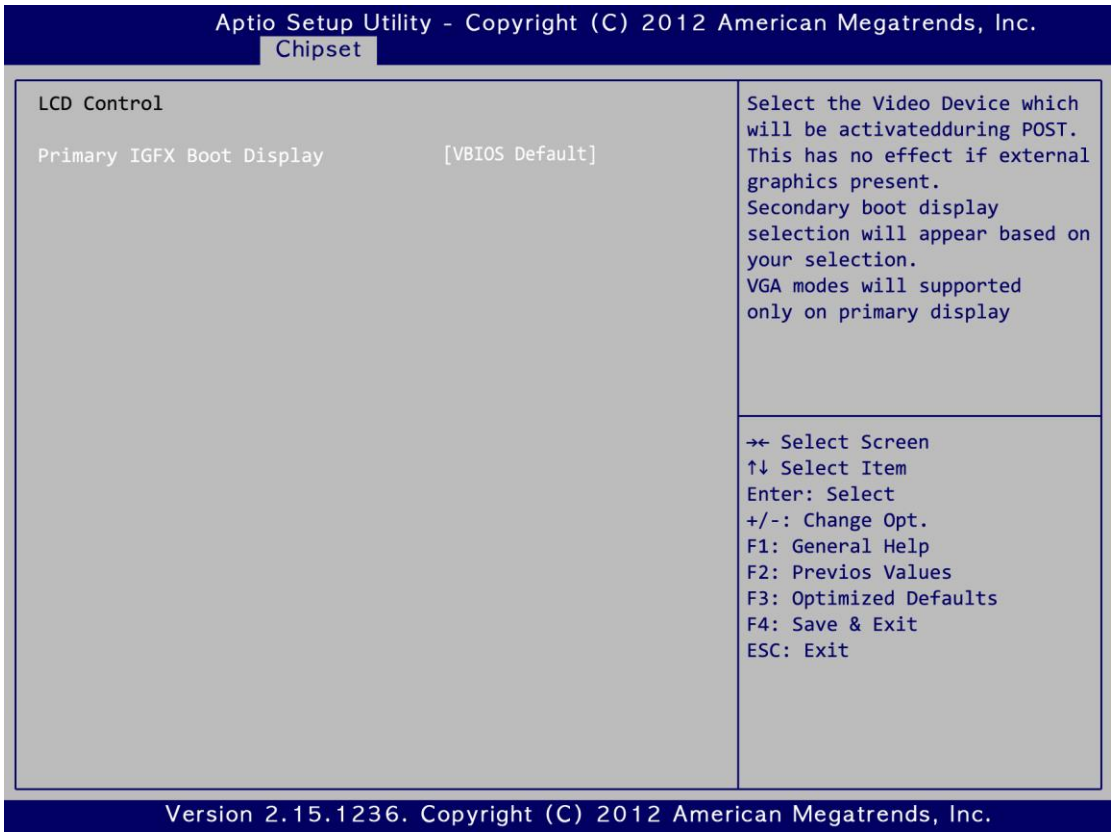
5.3.2 System Agent (SA) Configuration


Aptio Setup Utility - Copyright (C) 2012 American Megatrends, Inc.
Main Advanced Chipset Boot Security Save & Exit
System Agent Bridge Name Haswell
System Agent RC Version 1.5.0.0
VT-d Capability Supported
VT-d [Enabled]
CHAP Device (B0:D7:F0) [Disabled]
Thermal Device (B0:D4:F0) [Disabled]
CPU SA Audio Device (B0:D3:F0) [Enabled]
Graphics Configuration
NB PCIe Configuration
Memory Configuration
Check to enable VT-d function on MCH.
→← Select Screen
↑↓ Select Item
Enter: Select
+/-: Change Opt.
F1: General Help
F2: Previos Values
F3: Optimized Defaults
F4: Save & Exit
ESC: Exit
Version 2.15.1236. Copyright (C) 2012 American Megatrends, Inc.

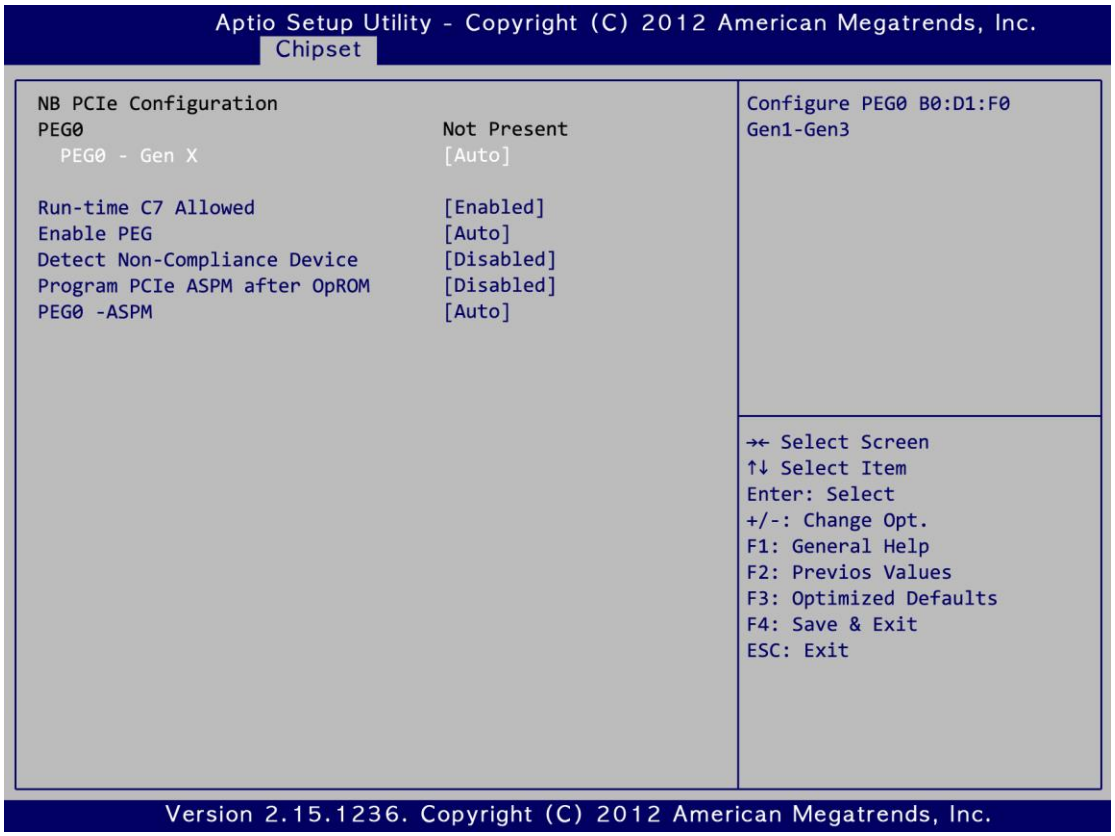
5.3.2.1 Graphic Configuration



5.3.2.1.1 LCD Control

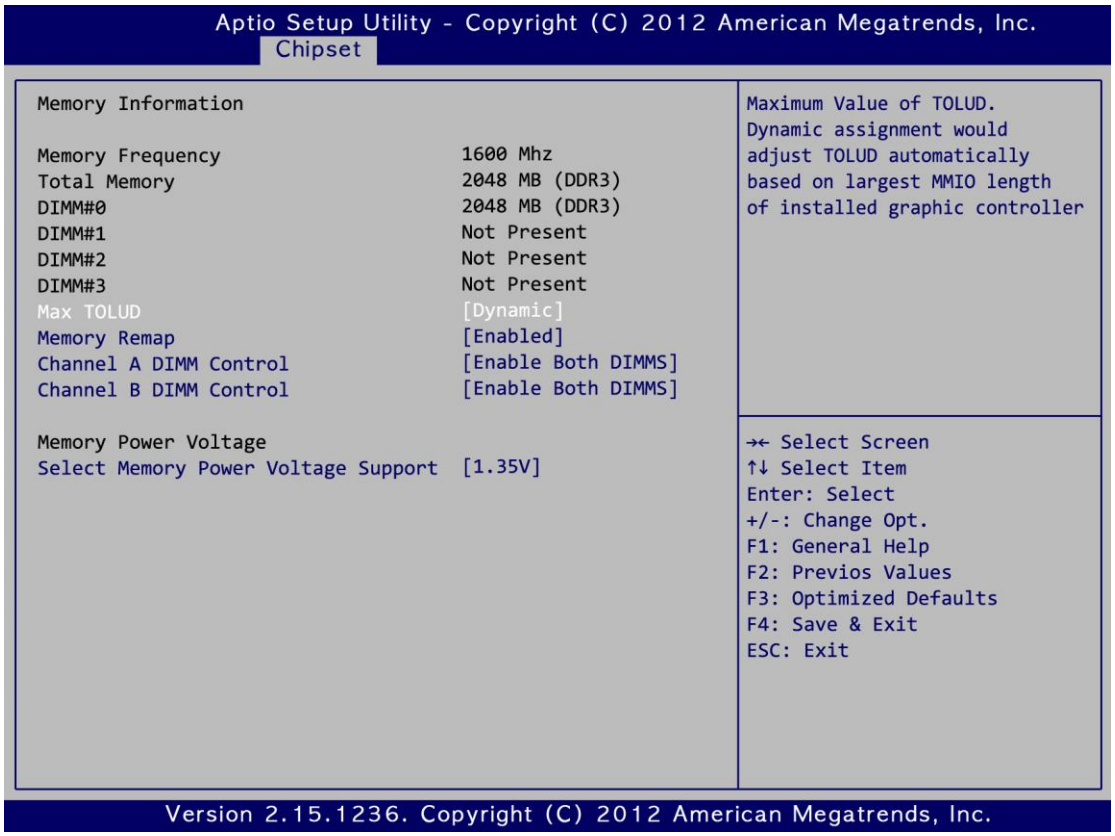

Aptio Setup Utility - Copyright (C) 2012 American Megatrends, Inc.
Chipset
LCD Control
Primary IGFX Boot Display
[VBIOS Default]
Select the Video Device which will be activatedduring POST. This has no effect if external graphics present. Secondary boot display selection will appear based on your selection. VGA modes will supported only on primary display
→← Select Screen
↑↓ Select Item
Enter: Select
+/-: Change Opt.
F1: General Help
F2: Previos Values
F3: Optimized Defaults
F4: Save & Exit
ESC: Exit
Version 2.15.1236. Copyright (C) 2012 American Megatrends, Inc.

5.3.2.2 NB PCIe Configuration

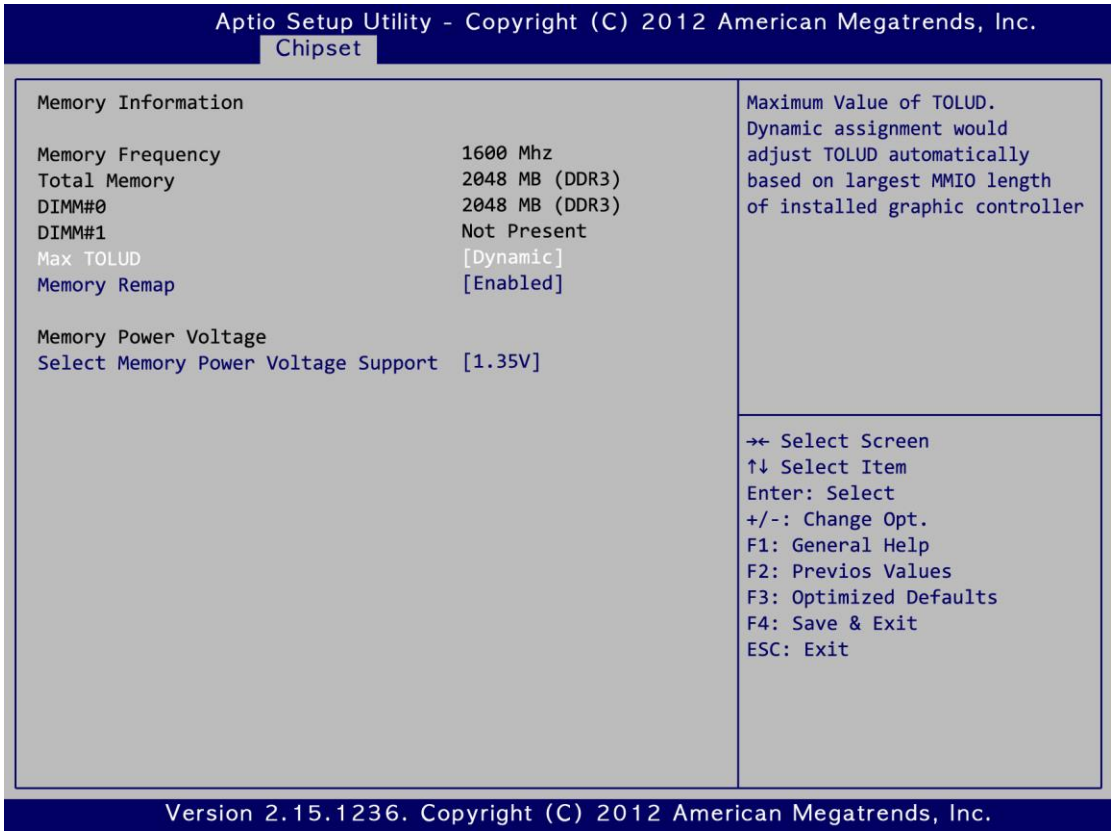


5.3.2.3 Memory Configuration

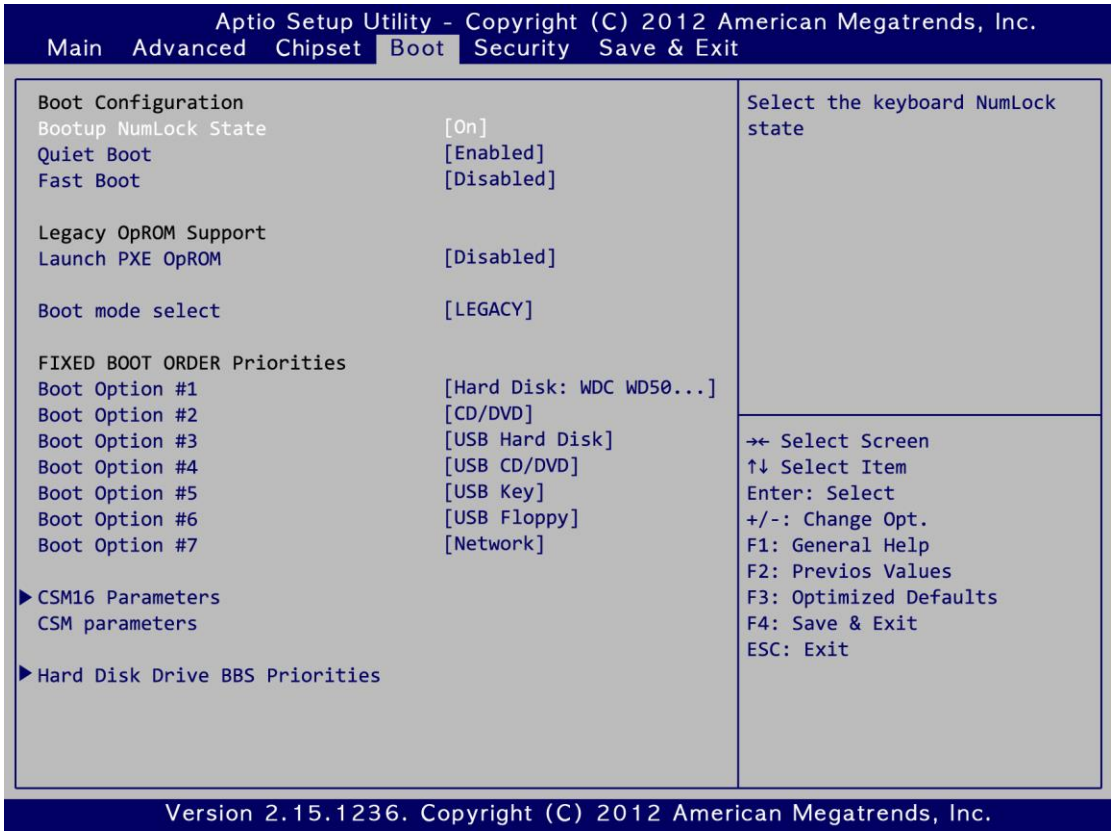
- CT-MHW01


Aptio Setup Utility - Copyright (C) 2012 American Megatrends, Inc.
Chipset
Memory Information
Memory Frequency 1600 Mhz
Total Memory 2048 MB (DDR3)
DIMM#0 2048 MB (DDR3)
DIMM#1 Not Present
DIMM#2 Not Present
DIMM#3 Not Present
Max TOLUD [Dynamic]
Memory Remap [Enabled]
Channel A DIMM Control [Enable Both DIMMS]
Channel B DIMM Control [Enable Both DIMMS]
Memory Power Voltage
Select Memory Power Voltage Support [1.35V]
Maximum Value of TOLUD. Dynamic assignment would adjust TOLUD automatically based on largest MMIO length of installed graphic controller
→← Select Screen
↑↓ Select Item
Enter: Select
+/-: Change Opt.
F1: General Help
F2: Previos Values
F3: Optimized Defaults
F4: Save & Exit
ESC: Exit
Version 2.15.1236. Copyright (C) 2012 American Megatrends, Inc.

- CT-MHW02


Aptio Setup Utility - Copyright (C) 2012 American Megatrends, Inc.
Chipset
Memory Information
Memory Frequency 1600 Mhz
Total Memory 2048 MB (DDR3)
DIMM#0 2048 MB (DDR3)
DIMM#1 Not Present
Max TOLUD [Dynamic]
Memory Remap [Enabled]
Memory Power Voltage
Select Memory Power Voltage Support [1.35V]
Maximum Value of TOLUD. Dynamic assignment would adjust TOLUD automatically based on largest MMIO length of installed graphic controller
→← Select Screen
↑↓ Select Item
Enter: Select
+/-: Change Opt.
F1: General Help
F2: Previos Values
F3: Optimized Defaults
F4: Save & Exit
ESC: Exit
Version 2.15.1236. Copyright (C) 2012 American Megatrends, Inc.

5.4 Boot


Aptio Setup Utility - Copyright (C) 2012 American Megatrends, Inc.
Main Advanced Chipset Boot Security Save & Exit
Boot Configuration
Bootup NumLock State [On]
Quiet Boot [Enabled]
Fast Boot [Disabled]
Legacy OpROM Support
Launch PXE OpROM [Disabled]
Boot mode select [LEGACY]
FIXED BOOT ORDER Priorities
Boot Option #1 [Hard Disk: WDC WD50...]
Boot Option #2 [CD/DVD]
Boot Option #3 [USB Hard Disk]
Boot Option #4 [USB CD/DVD]
Boot Option #5 [USB Key]
Boot Option #6 [USB Floppy]
Boot Option #7 [Network]
CSM16 Parameters
CSM parameters
Hard Disk Drive BBS Priorities
Select the keyboard NumLock state
→← Select Screen
↑↓ Select Item
Enter: Select
+/-: Change Opt.
F1: General Help
F2: Previos Values
F3: Optimized Defaults
F4: Save & Exit
ESC: Exit
Version 2.15.1236. Copyright (C) 2012 American Megatrends, Inc.

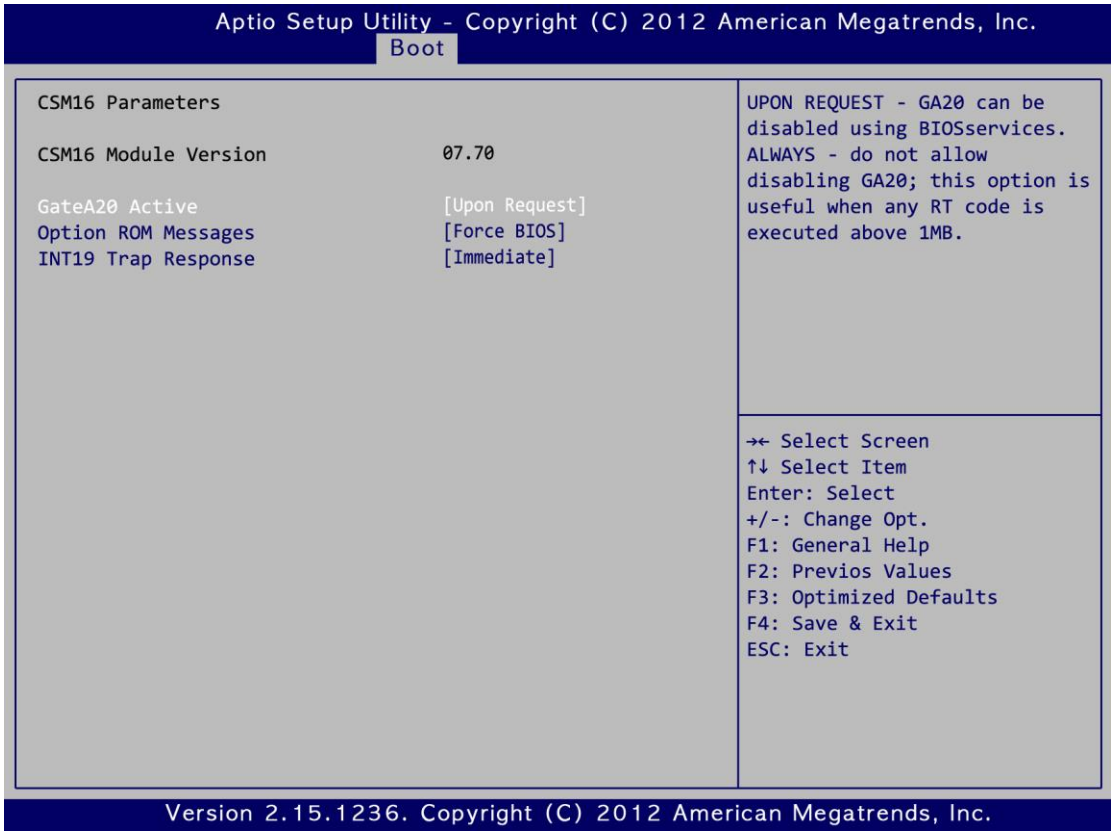
Boot Configuration: Number of seconds to wait for setup activation key. 65535 (0xFFFF) means indefinite waiting.

Bootup NumLock State: Select the keyboard NumLock state.

Fast Boot: Enables or disables boot with initialization of a minimal set of devices required to launch active boot option. Has no effect for BBS boot options.

5.4.1 CSM16 Parameters

OpROM execution, boot options filter, etc.

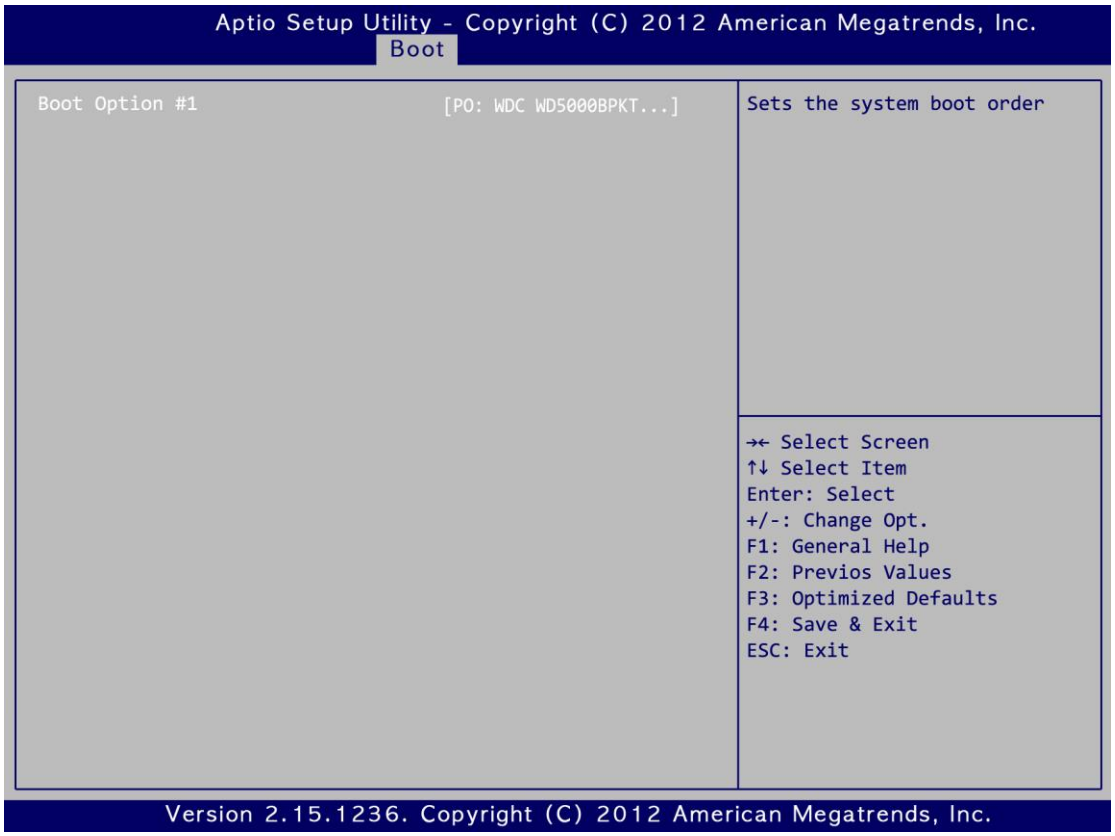

Aptio Setup Utility - Copyright (C) 2012 American Megatrends, Inc.
Boot
CSM16 Parameters
CSM16 Module Version 07.70
GateA20 Active [Upon Request]
Option ROM Messages [Force BIOS]
INT19 Trap Response [Immediate]
UPON REQUEST - GA20 can be disabled using BIOSservices. ALWAYS - do not allow disabling GA20; this option is useful when any RT code is executed above 1MB.
→← Select Screen
↑↓ Select Item
Enter: Select
+/-: Change Opt.
F1: General Help
F2: Previos Values
F3: Optimized Defaults
F4: Save & Exit
ESC: Exit
Version 2.15.1236. Copyright (C) 2012 American Megatrends, Inc.

GateA20 Active:

[Upon Request] – GA20 can be disabled using BIOS services. [Always] – do not allow disabling GA20; this option is useful wen any RT code is executed above 1MB.

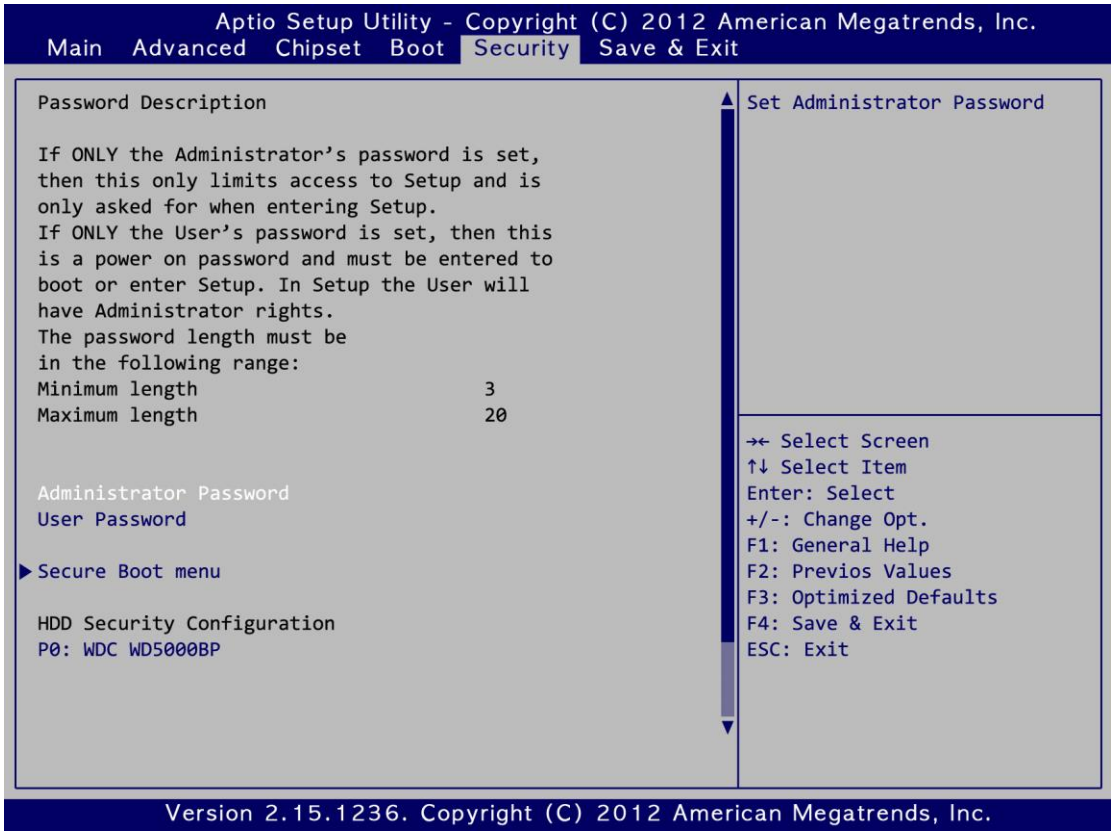
Option ROM Message: Set display mode [Force BIOS] or [Keep Current] for Option ROM.

5.4.2 Hard Disk Drive BBS Priorities

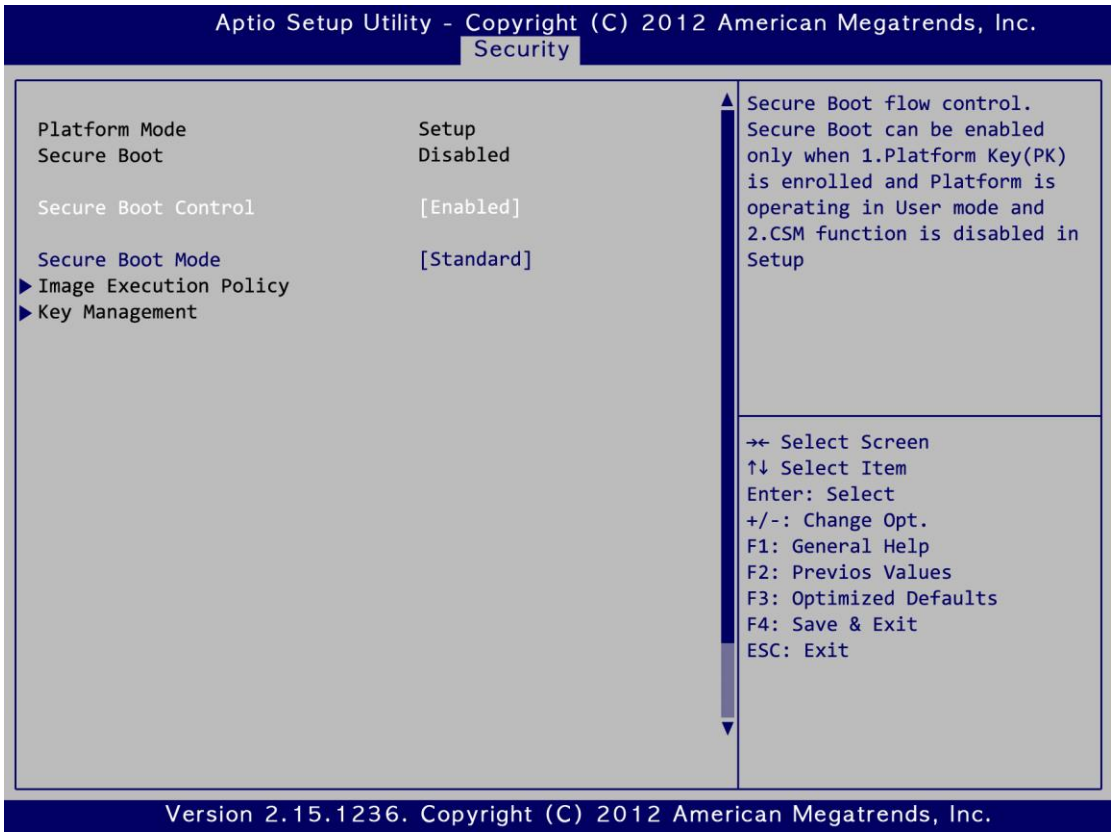


5.5 Security

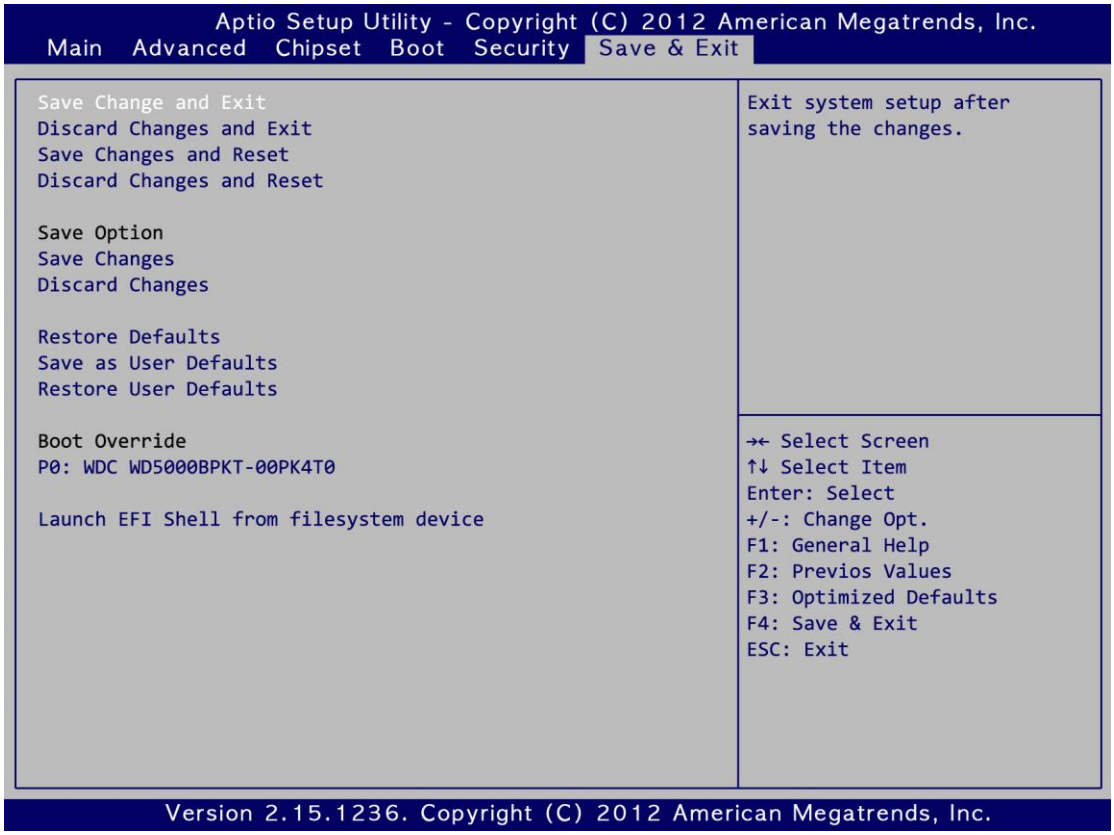
Administrator's and User's passwords could be set.
If ONLY the Administrator's password is set, then this only limits access to Setup and is only asked for when entering Setup. If ONLY the User's password is set, then this is a power on password and must be entered to boot or enter Setup. In Setup, the user will have administrator rights. The minimum length of the password is 3 and the maximum length is 20.


Aptio Setup Utility - Copyright (C) 2012 American Megatrends, Inc.
Main Advanced Chipset Boot Security Save & Exit
Password Description
If ONLY the Administrator's password is set,
then this only limits access to Setup and is
only asked for when entering Setup.
If ONLY the User's password is set, then this
is a power on password and must be entered to
boot or enter Setup. In Setup the User will
have Administrator rights.
The password length must be
in the following range:
Minimum length 3
Maximum length 20
Administrator Password
User Password
Secure Boot menu
HDD Security Configuration
P0: WDC WD5000BP
Set Administrator Password
→← Select Screen
↑↓ Select Item
Enter: Select
+/-: Change Opt.
F1: General Help
F2: Previos Values
F3: Optimized Defaults
F4: Save & Exit
ESC: Exit
Version 2.15.1236. Copyright (C) 2012 American Megatrends, Inc.

5.5.1 Secure Boot



5.6 Save and Exit



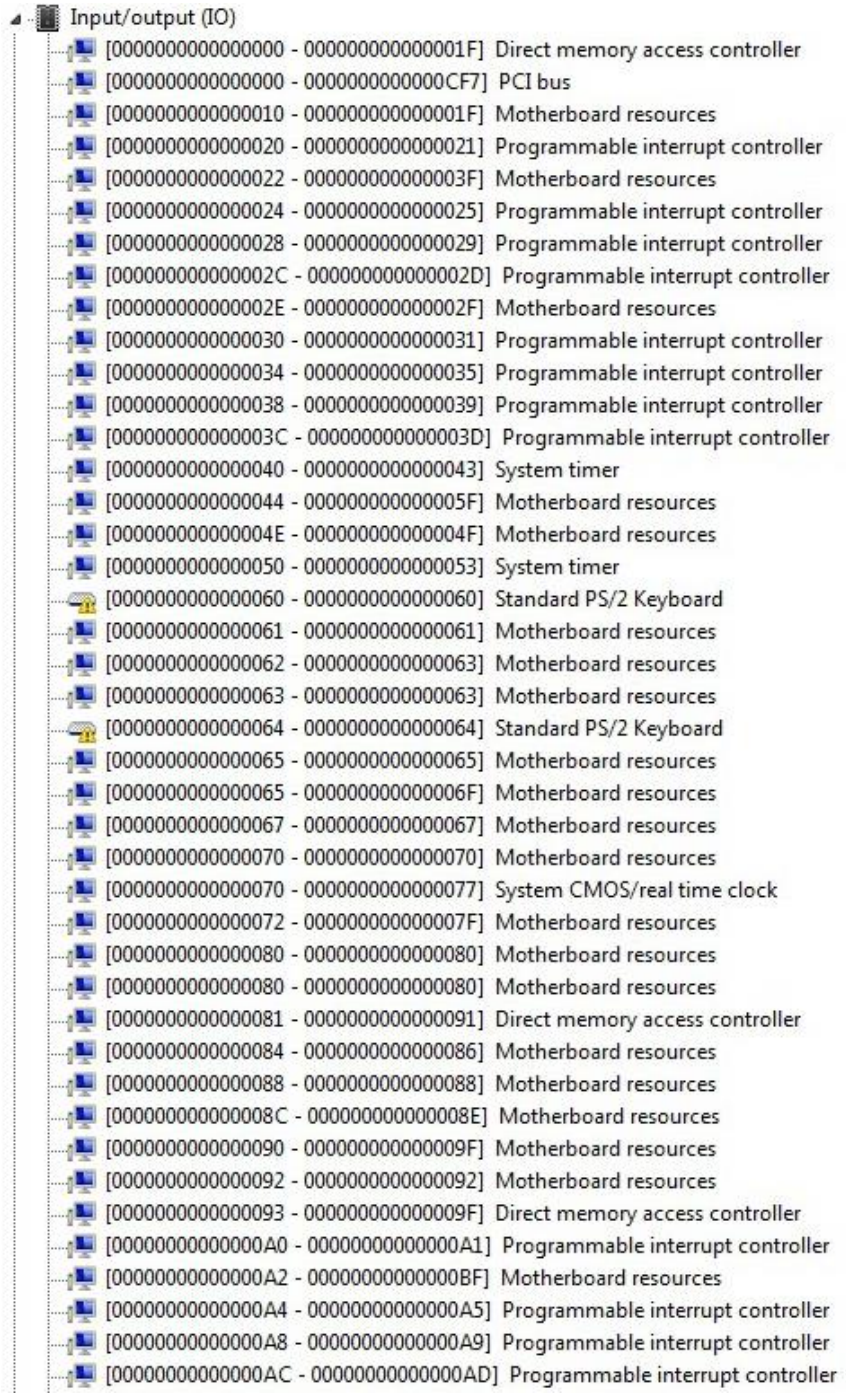
Save Changes and Exit: Exit system setup after saving the changes.
Discard Changes and Exit: Exit system setup without saving any changes.
Save Changes and Reset: Reset the system after saving the changes.
Discard Changes and Reset: Reset system setup without saving any changes.
Save Changes: Save Changes done so far to any of the setup options.
Discard Changes: Discard Changes done so far to any of the setup options.
Restore Defaults: Restore/Load Default values for all the setup options.
Save as User Defaults: Save the changes done so far as user Defaults.
Restore user Defaults: Restore the User Defaults to all the setup options.
Launch EFI Shell from filesystem device: Attempts to Launch EFI Shell application (Shellx64.efi) from one of the available filesystem devices.

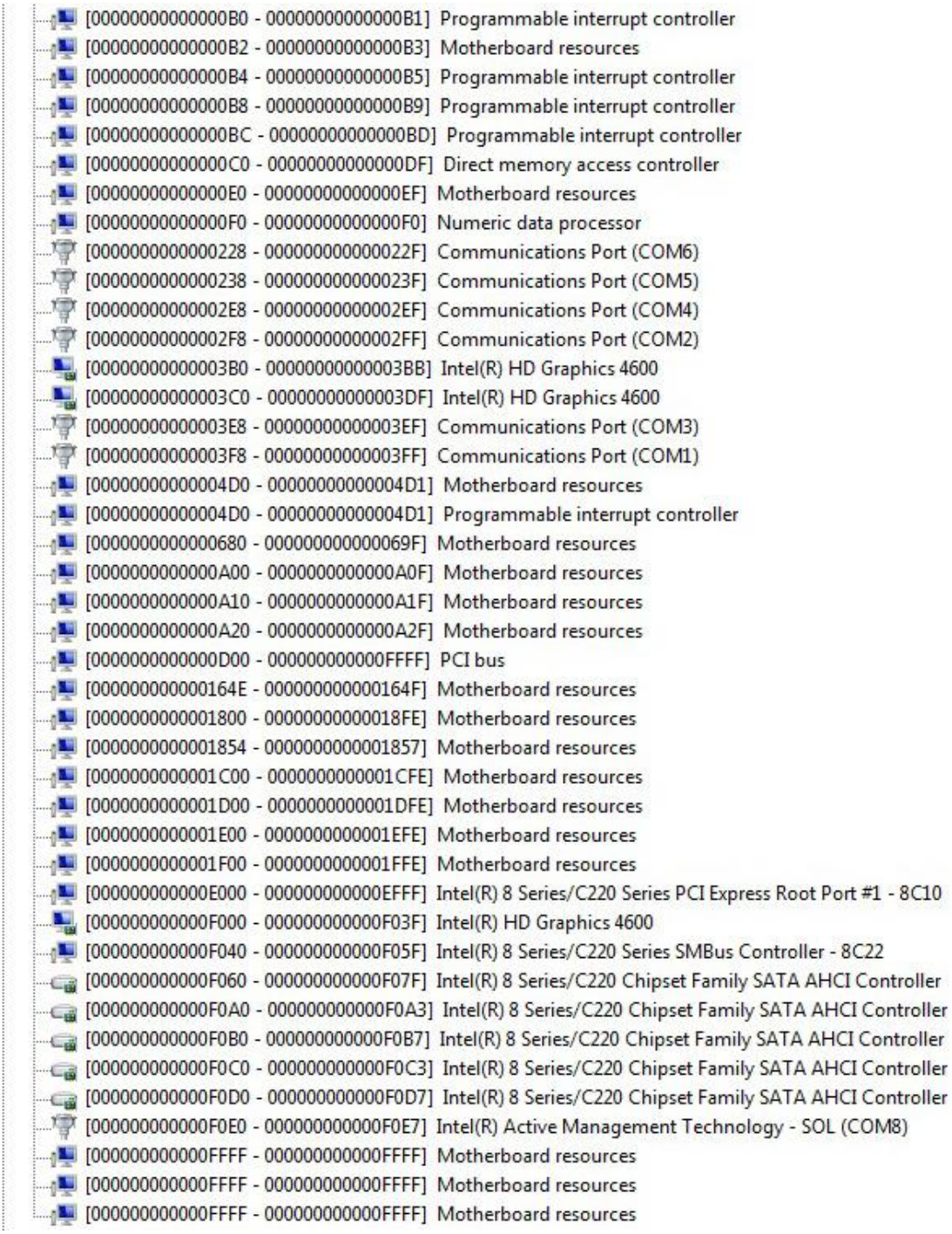
VI. Address Map

6.1 I/O Port Address Map

- CT-MHW01

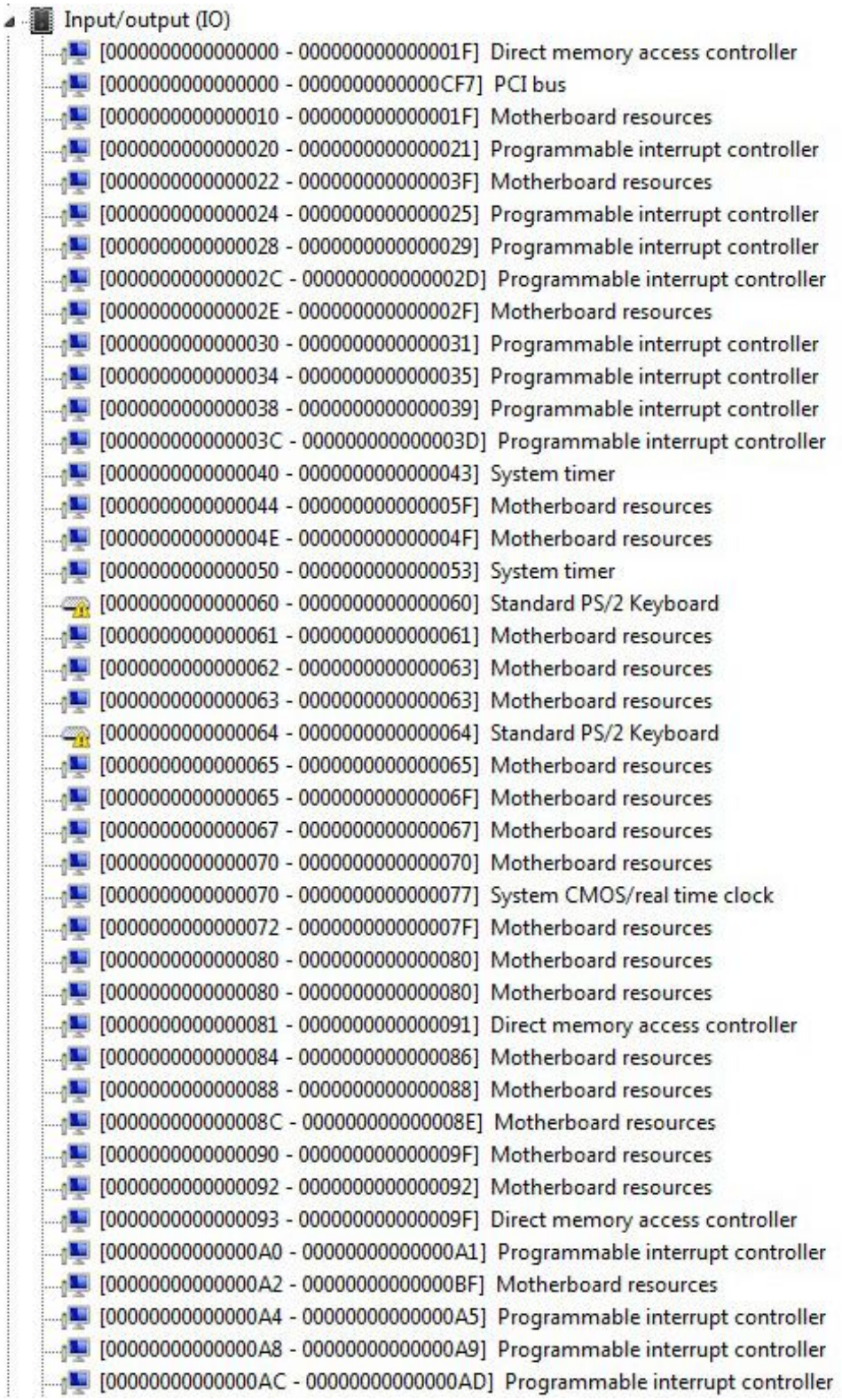
The assignment of the I/O port addresses for the CT-MHW01 under Windows® 7 Ultimate/64bit are shown below.




[00000000000000B0 - 00000000000000B1] Programmable interrupt controller
[00000000000000B2 - 00000000000000B3] Motherboard resources
[00000000000000B4 - 00000000000000B5] Programmable interrupt controller
[00000000000000B8 - 00000000000000B9] Programmable interrupt controller
[00000000000000BC - 00000000000000BD] Programmable interrupt controller
[00000000000000C0 - 00000000000000DF] Direct memory access controller
[00000000000000E0 - 00000000000000EF] Motherboard resources
[00000000000000F0 - 00000000000000F0] Numeric data processor
[0000000000000228 - 000000000000022F] Communications Port (COM6)
[0000000000000238 - 000000000000023F] Communications Port (COM5)
[00000000000002E8 - 00000000000002EF] Communications Port (COM4)
[00000000000002F8 - 00000000000002FF] Communications Port (COM2)
[00000000000003B0 - 00000000000003BB] Intel(R) HD Graphics 4600
[00000000000003C0 - 00000000000003DF] Intel(R) HD Graphics 4600
[00000000000003E8 - 00000000000003EF] Communications Port (COM3)
[00000000000003F8 - 00000000000003FF] Communications Port (COM1)
[00000000000004D0 - 00000000000004D1] Motherboard resources
[00000000000004D0 - 00000000000004D1] Programmable interrupt controller
[0000000000000680 - 000000000000069F] Motherboard resources
[0000000000000A00 - 0000000000000A0F] Motherboard resources
[0000000000000A10 - 0000000000000A1F] Motherboard resources
[0000000000000A20 - 0000000000000A2F] Motherboard resources
[0000000000000D00 - 000000000000FFFF] PCI bus
[000000000000164E - 000000000000164F] Motherboard resources
[0000000000001800 - 00000000000018FE] Motherboard resources
[0000000000001854 - 0000000000001857] Motherboard resources
[0000000000001C00 - 0000000000001CFE] Motherboard resources
[0000000000001D00 - 0000000000001DFE] Motherboard resources
[0000000000001E00 - 0000000000001EFE] Motherboard resources
[0000000000001F00 - 0000000000001FFE] Motherboard resources
[000000000000E000 - 000000000000EFFF] Intel(R) 8 Series/C220 Series PCI Express Root Port #1 - 8C10
[000000000000F000 - 000000000000F03F] Intel(R) HD Graphics 4600
[000000000000F040 - 000000000000F05F] Intel(R) 8 Series/C220 Series SMBus Controller - 8C22
[000000000000F060 - 000000000000F07F] Intel(R) 8 Series/C220 Chipset Family SATA AHCI Controller
[000000000000F0A0 - 000000000000F0A3] Intel(R) 8 Series/C220 Chipset Family SATA AHCI Controller
[000000000000F0B0 - 000000000000F0B7] Intel(R) 8 Series/C220 Chipset Family SATA AHCI Controller
[000000000000F0C0 - 000000000000F0C3] Intel(R) 8 Series/C220 Chipset Family SATA AHCI Controller
[000000000000F0D0 - 000000000000F0D7] Intel(R) 8 Series/C220 Chipset Family SATA AHCI Controller
[000000000000F0E0 - 000000000000F0E7] Intel(R) Active Management Technology - SOL (COM8)
[000000000000FFFF - 000000000000FFFF] Motherboard resources
[000000000000FFFF - 000000000000FFFF] Motherboard resources
[000000000000FFFF - 000000000000FFFF] Motherboard resources

- CT-MHW02

The assignment of the I/O port addresses for the CT-MHW01 under Windows® 7 Ultimate/64bit are shown below.

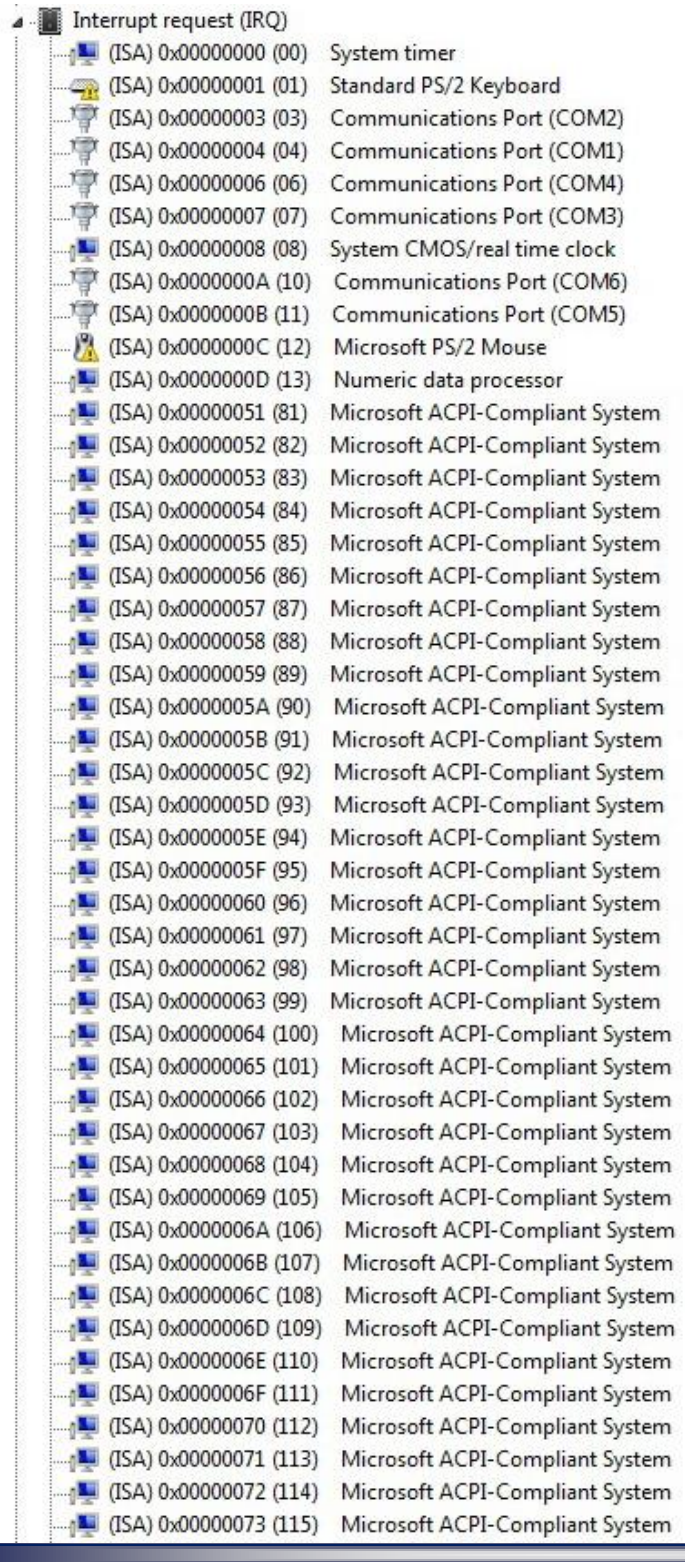


- [00000000000000B0 - 00000000000000B1] Programmable interrupt controller
- [00000000000000B2 - 00000000000000B3] Motherboard resources
- [00000000000000B4 - 00000000000000B5] Programmable interrupt controller
- [00000000000000B8 - 00000000000000B9] Programmable interrupt controller
- [00000000000000BC - 00000000000000BD] Programmable interrupt controller
- [00000000000000C0 - 00000000000000DF] Direct memory access controller
- [00000000000000E0 - 00000000000000EF] Motherboard resources
- [00000000000000F0 - 00000000000000F0] Numeric data processor
- [0000000000000228 - 000000000000022F] Communications Port (COM6)
- [0000000000000238 - 000000000000023F] Communications Port (COM5)
- [0000000000000260 - 0000000000000267] Communications Port (COM3)
- [0000000000000268 - 000000000000026F] Communications Port (COM4)
- [0000000000000270 - 0000000000000277] Communications Port (COM5)
- [0000000000000278 - 000000000000027F] Communications Port (COM6)
- [00000000000002E8 - 00000000000002EF] Communications Port (COM4)
- [00000000000002F8 - 00000000000002FF] Communications Port (COM2)
- [00000000000003B0 - 00000000000003BB] Intel(R) HD Graphics 4600
- [00000000000003C0 - 00000000000003DF] Intel(R) HD Graphics 4600
- [00000000000003E8 - 00000000000003EF] Communications Port (COM3)
- [00000000000003F8 - 00000000000003FF] Communications Port (COM1)
- [00000000000004D0 - 00000000000004D1] Motherboard resources
- [00000000000004D0 - 00000000000004D1] Programmable interrupt controller
- [0000000000000680 - 000000000000069F] Motherboard resources
- [0000000000000A00 - 0000000000000A0F] Motherboard resources
- [0000000000000A10 - 0000000000000A1F] Motherboard resources
- [0000000000000A20 - 0000000000000A2F] Motherboard resources
- [0000000000000D00 - 000000000000FFFF] PCI bus
- [000000000000164E - 000000000000164F] Motherboard resources
- [0000000000001800 - 00000000000018FE] Motherboard resources
- [0000000000001854 - 0000000000001857] Motherboard resources
- [0000000000001C00 - 0000000000001CFE] Motherboard resources
- [0000000000001D00 - 0000000000001DFE] Motherboard resources
- [0000000000001E00 - 0000000000001EFE] Motherboard resources
- [0000000000001F00 - 0000000000001FFE] Motherboard resources
- [000000000000E000 - 000000000000EFFF] Intel(R) 8 Series/C220 Series PCI Express Root Port #1 - 8C10
- [000000000000F000 - 000000000000F03F] Intel(R) HD Graphics 4600
- [000000000000F040 - 000000000000F05F] Intel(R) 8 Series/C220 Series SMBus Controller - 8C22
- [000000000000F060 - 000000000000F07F] Intel(R) 8 Series/C220 Chipset Family SATA AHCI Controller
- [000000000000F0A0 - 000000000000F0A3] Intel(R) 8 Series/C220 Chipset Family SATA AHCI Controller
- [000000000000F0B0 - 000000000000F0B7] Intel(R) 8 Series/C220 Chipset Family SATA AHCI Controller
- [000000000000F0C0 - 000000000000F0C3] Intel(R) 8 Series/C220 Chipset Family SATA AHCI Controller
- [000000000000F0D0 - 000000000000F0D7] Intel(R) 8 Series/C220 Chipset Family SATA AHCI Controller
- [000000000000FFFF - 000000000000FFFF] Motherboard resources
- [000000000000FFFF - 000000000000FFFF] Motherboard resources
- [000000000000FFFF - 000000000000FFFF] Motherboard resources

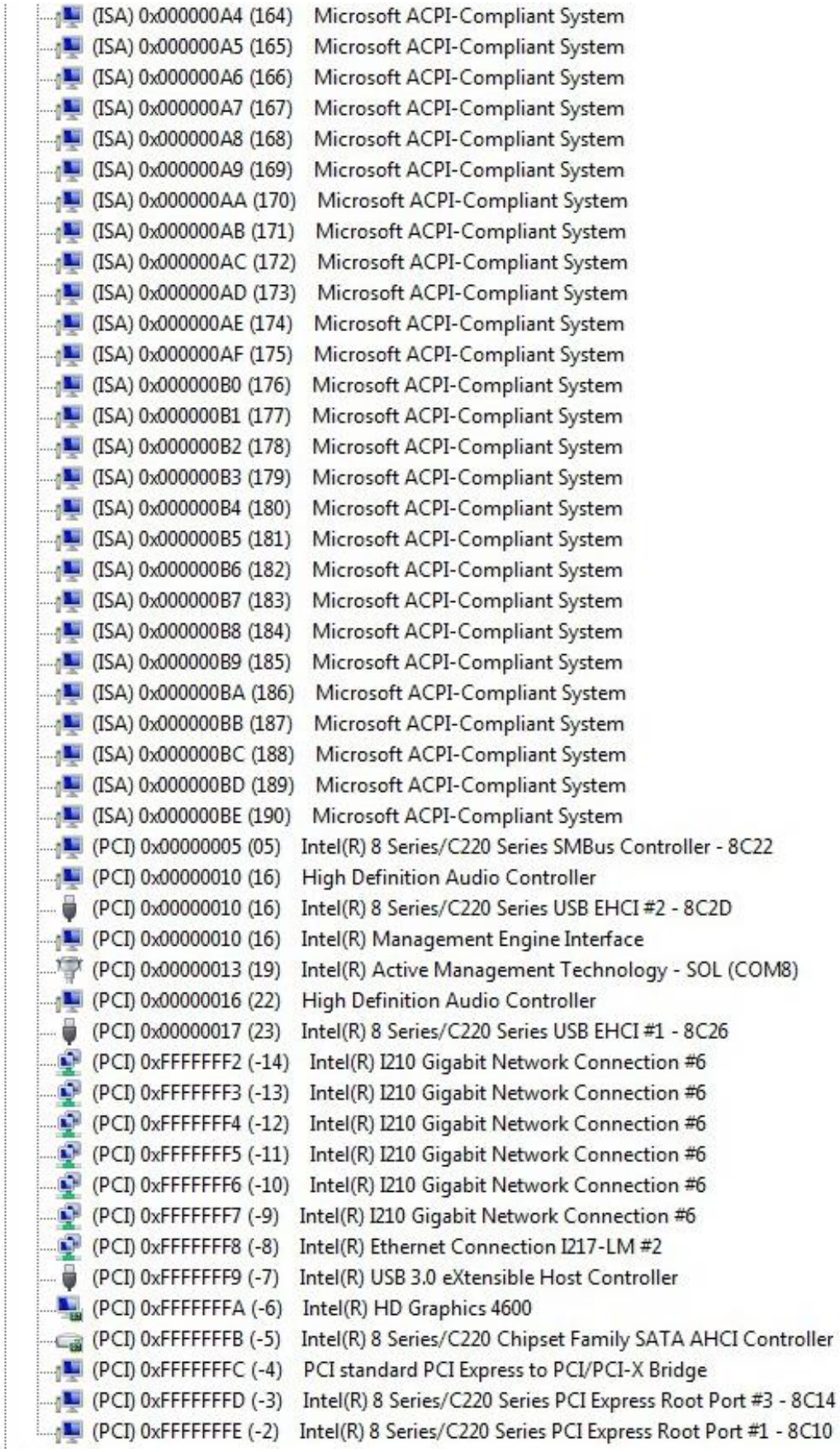
6.2 Interrupt Controller (IRQ) Map

- CT-MHW01

The interrupt controller map for the CT-MHW01 under Windows® 7 Ultimate/64bit are as shown below.

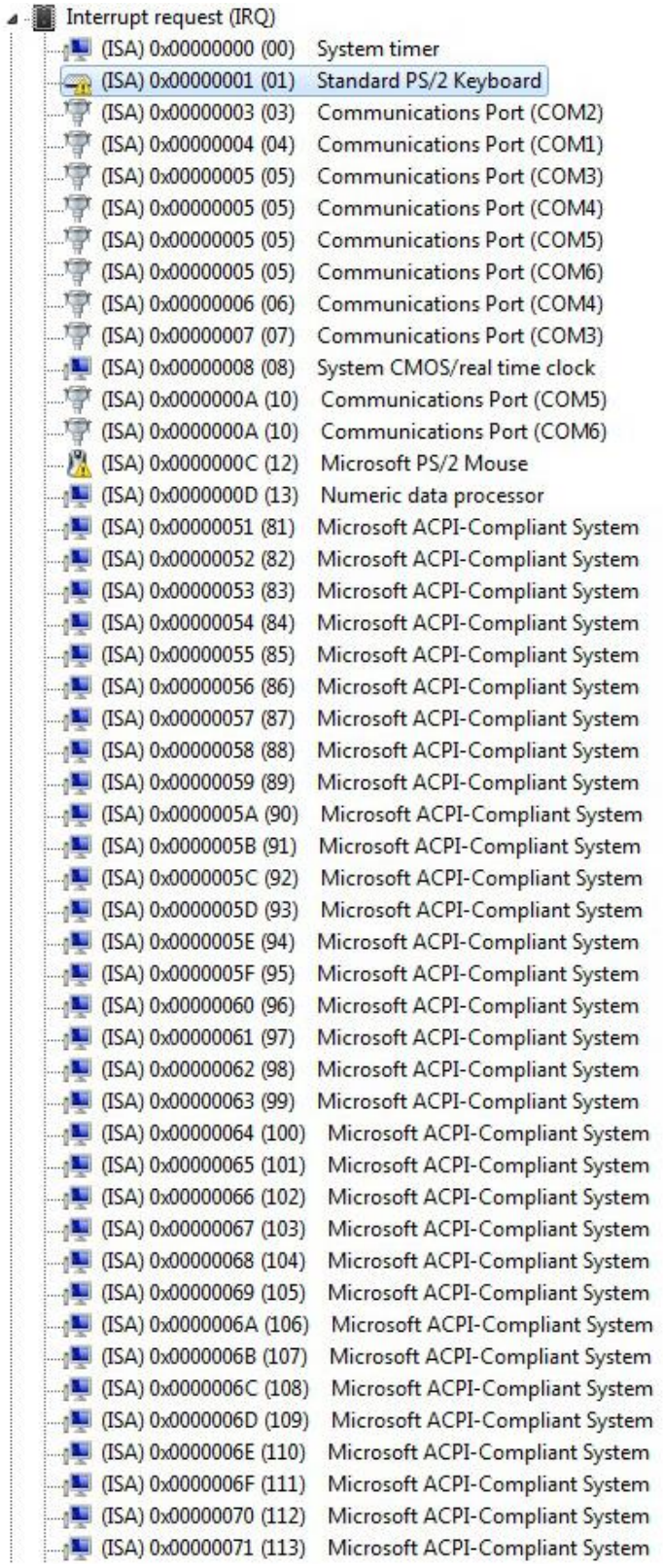

Interrupt request (IRQ)
(ISA) 0x00000000 (00) System timer
(ISA) 0x00000001 (01) Standard PS/2 Keyboard
(ISA) 0x00000003 (03) Communications Port (COM2)
(ISA) 0x00000004 (04) Communications Port (COM1)
(ISA) 0x00000006 (06) Communications Port (COM4)
(ISA) 0x00000007 (07) Communications Port (COM3)
(ISA) 0x00000008 (08) System CMOS/real time clock
(ISA) 0x0000000A (10) Communications Port (COM6)
(ISA) 0x0000000B (11) Communications Port (COM5)
(ISA) 0x0000000C (12) Microsoft PS/2 Mouse
(ISA) 0x0000000D (13) Numeric data processor
(ISA) 0x00000051 (81) Microsoft ACPI-Compliant System
(ISA) 0x00000052 (82) Microsoft ACPI-Compliant System
(ISA) 0x00000053 (83) Microsoft ACPI-Compliant System
(ISA) 0x00000054 (84) Microsoft ACPI-Compliant System
(ISA) 0x00000055 (85) Microsoft ACPI-Compliant System
(ISA) 0x00000056 (86) Microsoft ACPI-Compliant System
(ISA) 0x00000057 (87) Microsoft ACPI-Compliant System
(ISA) 0x00000058 (88) Microsoft ACPI-Compliant System
(ISA) 0x00000059 (89) Microsoft ACPI-Compliant System
(ISA) 0x0000005A (90) Microsoft ACPI-Compliant System
(ISA) 0x0000005B (91) Microsoft ACPI-Compliant System
(ISA) 0x0000005C (92) Microsoft ACPI-Compliant System
(ISA) 0x0000005D (93) Microsoft ACPI-Compliant System
(ISA) 0x0000005E (94) Microsoft ACPI-Compliant System
(ISA) 0x0000005F (95) Microsoft ACPI-Compliant System
(ISA) 0x00000060 (96) Microsoft ACPI-Compliant System
(ISA) 0x00000061 (97) Microsoft ACPI-Compliant System
(ISA) 0x00000062 (98) Microsoft ACPI-Compliant System
(ISA) 0x00000063 (99) Microsoft ACPI-Compliant System
(ISA) 0x00000064 (100) Microsoft ACPI-Compliant System
(ISA) 0x00000065 (101) Microsoft ACPI-Compliant System
(ISA) 0x00000066 (102) Microsoft ACPI-Compliant System
(ISA) 0x00000067 (103) Microsoft ACPI-Compliant System
(ISA) 0x00000068 (104) Microsoft ACPI-Compliant System
(ISA) 0x00000069 (105) Microsoft ACPI-Compliant System
(ISA) 0x0000006A (106) Microsoft ACPI-Compliant System
(ISA) 0x0000006B (107) Microsoft ACPI-Compliant System
(ISA) 0x0000006C (108) Microsoft ACPI-Compliant System
(ISA) 0x0000006D (109) Microsoft ACPI-Compliant System
(ISA) 0x0000006E (110) Microsoft ACPI-Compliant System
(ISA) 0x0000006F (111) Microsoft ACPI-Compliant System
(ISA) 0x00000070 (112) Microsoft ACPI-Compliant System
(ISA) 0x00000071 (113) Microsoft ACPI-Compliant System
(ISA) 0x00000072 (114) Microsoft ACPI-Compliant System
(ISA) 0x00000073 (115) Microsoft ACPI-Compliant System

(ISA) 0x00000074 (116) Microsoft ACPI-Compliant System
(ISA) 0x00000075 (117) Microsoft ACPI-Compliant System
(ISA) 0x00000076 (118) Microsoft ACPI-Compliant System
(ISA) 0x00000077 (119) Microsoft ACPI-Compliant System
(ISA) 0x00000078 (120) Microsoft ACPI-Compliant System
(ISA) 0x00000079 (121) Microsoft ACPI-Compliant System
(ISA) 0x0000007A (122) Microsoft ACPI-Compliant System
(ISA) 0x0000007B (123) Microsoft ACPI-Compliant System
(ISA) 0x0000007C (124) Microsoft ACPI-Compliant System
(ISA) 0x0000007D (125) Microsoft ACPI-Compliant System
(ISA) 0x0000007E (126) Microsoft ACPI-Compliant System
(ISA) 0x0000007F (127) Microsoft ACPI-Compliant System
(ISA) 0x00000080 (128) Microsoft ACPI-Compliant System
(ISA) 0x00000081 (129) Microsoft ACPI-Compliant System
(ISA) 0x00000082 (130) Microsoft ACPI-Compliant System
(ISA) 0x00000083 (131) Microsoft ACPI-Compliant System
(ISA) 0x00000084 (132) Microsoft ACPI-Compliant System
(ISA) 0x00000085 (133) Microsoft ACPI-Compliant System
(ISA) 0x00000086 (134) Microsoft ACPI-Compliant System
(ISA) 0x00000087 (135) Microsoft ACPI-Compliant System
(ISA) 0x00000088 (136) Microsoft ACPI-Compliant System
(ISA) 0x00000089 (137) Microsoft ACPI-Compliant System
(ISA) 0x0000008A (138) Microsoft ACPI-Compliant System
(ISA) 0x0000008B (139) Microsoft ACPI-Compliant System
(ISA) 0x0000008C (140) Microsoft ACPI-Compliant System
(ISA) 0x0000008D (141) Microsoft ACPI-Compliant System
(ISA) 0x0000008E (142) Microsoft ACPI-Compliant System
(ISA) 0x0000008F (143) Microsoft ACPI-Compliant System
(ISA) 0x00000090 (144) Microsoft ACPI-Compliant System
(ISA) 0x00000091 (145) Microsoft ACPI-Compliant System
(ISA) 0x00000092 (146) Microsoft ACPI-Compliant System
(ISA) 0x00000093 (147) Microsoft ACPI-Compliant System
(ISA) 0x00000094 (148) Microsoft ACPI-Compliant System
(ISA) 0x00000095 (149) Microsoft ACPI-Compliant System
(ISA) 0x00000096 (150) Microsoft ACPI-Compliant System
(ISA) 0x00000097 (151) Microsoft ACPI-Compliant System
(ISA) 0x00000098 (152) Microsoft ACPI-Compliant System
(ISA) 0x00000099 (153) Microsoft ACPI-Compliant System
(ISA) 0x0000009A (154) Microsoft ACPI-Compliant System
(ISA) 0x0000009B (155) Microsoft ACPI-Compliant System
(ISA) 0x0000009C (156) Microsoft ACPI-Compliant System
(ISA) 0x0000009D (157) Microsoft ACPI-Compliant System
(ISA) 0x0000009E (158) Microsoft ACPI-Compliant System
(ISA) 0x0000009F (159) Microsoft ACPI-Compliant System
(ISA) 0x000000A0 (160) Microsoft ACPI-Compliant System
(ISA) 0x000000A1 (161) Microsoft ACPI-Compliant System
(ISA) 0x000000A2 (162) Microsoft ACPI-Compliant System
(ISA) 0x000000A3 (163) Microsoft ACPI-Compliant System


(ISA) 0x000000A4 (164) Microsoft ACPI-Compliant System
(ISA) 0x000000A5 (165) Microsoft ACPI-Compliant System
(ISA) 0x000000A6 (166) Microsoft ACPI-Compliant System
(ISA) 0x000000A7 (167) Microsoft ACPI-Compliant System
(ISA) 0x000000A8 (168) Microsoft ACPI-Compliant System
(ISA) 0x000000A9 (169) Microsoft ACPI-Compliant System
(ISA) 0x000000AA (170) Microsoft ACPI-Compliant System
(ISA) 0x000000AB (171) Microsoft ACPI-Compliant System
(ISA) 0x000000AC (172) Microsoft ACPI-Compliant System
(ISA) 0x000000AD (173) Microsoft ACPI-Compliant System
(ISA) 0x000000AE (174) Microsoft ACPI-Compliant System
(ISA) 0x000000AF (175) Microsoft ACPI-Compliant System
(ISA) 0x000000B0 (176) Microsoft ACPI-Compliant System
(ISA) 0x000000B1 (177) Microsoft ACPI-Compliant System
(ISA) 0x000000B2 (178) Microsoft ACPI-Compliant System
(ISA) 0x000000B3 (179) Microsoft ACPI-Compliant System
(ISA) 0x000000B4 (180) Microsoft ACPI-Compliant System
(ISA) 0x000000B5 (181) Microsoft ACPI-Compliant System
(ISA) 0x000000B6 (182) Microsoft ACPI-Compliant System
(ISA) 0x000000B7 (183) Microsoft ACPI-Compliant System
(ISA) 0x000000B8 (184) Microsoft ACPI-Compliant System
(ISA) 0x000000B9 (185) Microsoft ACPI-Compliant System
(ISA) 0x000000BA (186) Microsoft ACPI-Compliant System
(ISA) 0x000000BB (187) Microsoft ACPI-Compliant System
(ISA) 0x000000BC (188) Microsoft ACPI-Compliant System
(ISA) 0x000000BD (189) Microsoft ACPI-Compliant System
(ISA) 0x000000BE (190) Microsoft ACPI-Compliant System
(PCI) 0x00000005 (05) Intel(R) 8 Series/C220 Series SMBus Controller - 8C22
(PCI) 0x00000010 (16) High Definition Audio Controller
(PCI) 0x00000010 (16) Intel(R) 8 Series/C220 Series USB EHCI #2 - 8C2D
(PCI) 0x00000010 (16) Intel(R) Management Engine Interface
(PCI) 0x00000013 (19) Intel(R) Active Management Technology - SOL (COM8)
(PCI) 0x00000016 (22) High Definition Audio Controller
(PCI) 0x00000017 (23) Intel(R) 8 Series/C220 Series USB EHCI #1 - 8C26
(PCI) 0xFFFFFFF2 (-14) Intel(R) I210 Gigabit Network Connection #6
(PCI) 0xFFFFFFF3 (-13) Intel(R) I210 Gigabit Network Connection #6
(PCI) 0xFFFFFFF4 (-12) Intel(R) I210 Gigabit Network Connection #6
(PCI) 0xFFFFFFF5 (-11) Intel(R) I210 Gigabit Network Connection #6
(PCI) 0xFFFFFFF6 (-10) Intel(R) I210 Gigabit Network Connection #6
(PCI) 0xFFFFFFF7 (-9) Intel(R) I210 Gigabit Network Connection #6
(PCI) 0xFFFFFFF8 (-8) Intel(R) Ethernet Connection I217-LM #2
(PCI) 0xFFFFFFF9 (-7) Intel(R) USB 3.0 eXtensible Host Controller
(PCI) 0xFFFFFFFA (-6) Intel(R) HD Graphics 4600
(PCI) 0xFFFFFFFB (-5) Intel(R) 8 Series/C220 Chipset Family SATA AHCI Controller
(PCI) 0xFFFFFFFC (-4) PCI standard PCI Express to PCI/PCI-X Bridge
(PCI) 0xFFFFFFFD (-3) Intel(R) 8 Series/C220 Series PCI Express Root Port #3 - 8C14
(PCI) 0xFFFFFFFE (-2) Intel(R) 8 Series/C220 Series PCI Express Root Port #1 - 8C10

- CT-MHW02

The interrupt controller map for the CT-MHW02 under Windows® 7 Ultimate/64bit are as shown below.


Interrupt request (IRQ)
(ISA) 0x00000000 (00) System timer
(ISA) 0x00000001 (01) Standard PS/2 Keyboard
(ISA) 0x00000003 (03) Communications Port (COM2)
(ISA) 0x00000004 (04) Communications Port (COM1)
(ISA) 0x00000005 (05) Communications Port (COM3)
(ISA) 0x00000005 (05) Communications Port (COM4)
(ISA) 0x00000005 (05) Communications Port (COM5)
(ISA) 0x00000005 (05) Communications Port (COM6)
(ISA) 0x00000006 (06) Communications Port (COM4)
(ISA) 0x00000007 (07) Communications Port (COM3)
(ISA) 0x00000008 (08) System CMOS/real time clock
(ISA) 0x0000000A (10) Communications Port (COM5)
(ISA) 0x0000000A (10) Communications Port (COM6)
(ISA) 0x0000000C (12) Microsoft PS/2 Mouse
(ISA) 0x0000000D (13) Numeric data processor
(ISA) 0x00000051 (81) Microsoft ACPI-Compliant System
(ISA) 0x00000052 (82) Microsoft ACPI-Compliant System
(ISA) 0x00000053 (83) Microsoft ACPI-Compliant System
(ISA) 0x00000054 (84) Microsoft ACPI-Compliant System
(ISA) 0x00000055 (85) Microsoft ACPI-Compliant System
(ISA) 0x00000056 (86) Microsoft ACPI-Compliant System
(ISA) 0x00000057 (87) Microsoft ACPI-Compliant System
(ISA) 0x00000058 (88) Microsoft ACPI-Compliant System
(ISA) 0x00000059 (89) Microsoft ACPI-Compliant System
(ISA) 0x0000005A (90) Microsoft ACPI-Compliant System
(ISA) 0x0000005B (91) Microsoft ACPI-Compliant System
(ISA) 0x0000005C (92) Microsoft ACPI-Compliant System
(ISA) 0x0000005D (93) Microsoft ACPI-Compliant System
(ISA) 0x0000005E (94) Microsoft ACPI-Compliant System
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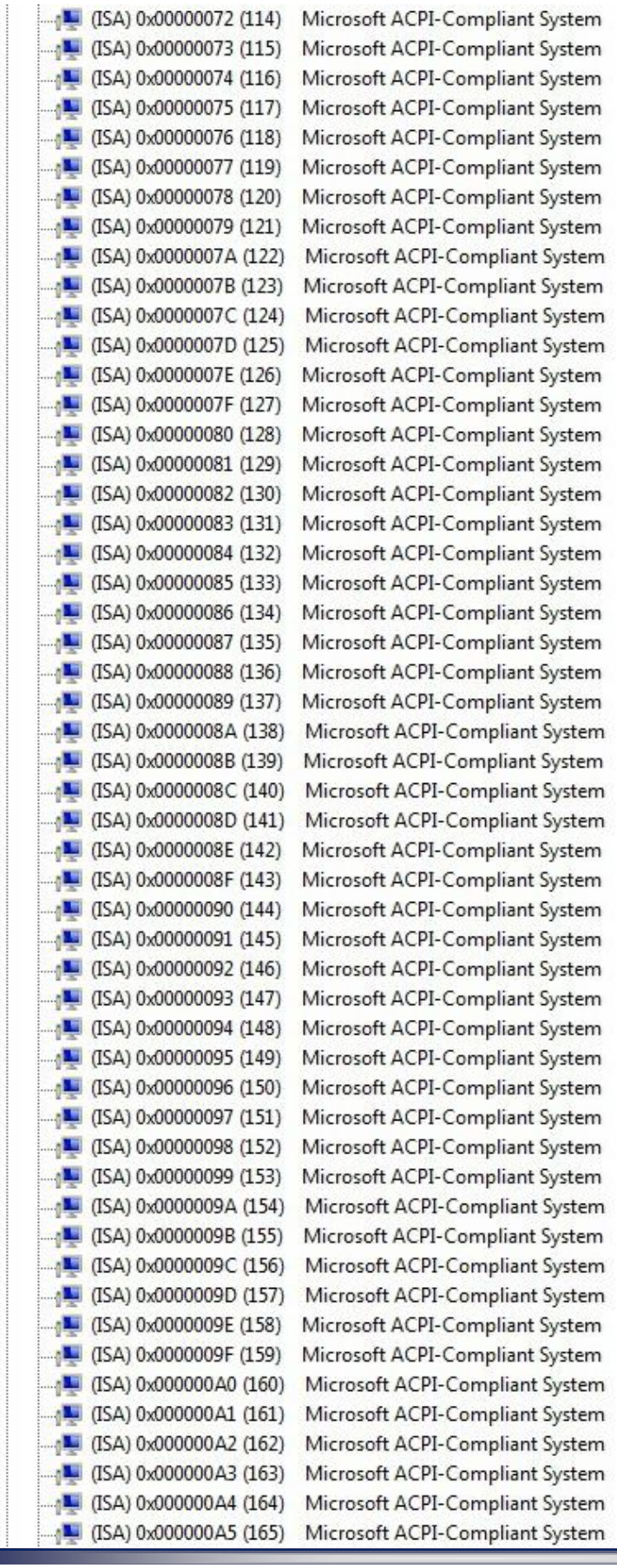
(ISA) 0x00000060 (96) Microsoft ACPI-Compliant System
(ISA) 0x00000061 (97) Microsoft ACPI-Compliant System
(ISA) 0x00000062 (98) Microsoft ACPI-Compliant System
(ISA) 0x00000063 (99) Microsoft ACPI-Compliant System
(ISA) 0x00000064 (100) Microsoft ACPI-Compliant System
(ISA) 0x00000065 (101) Microsoft ACPI-Compliant System
(ISA) 0x00000066 (102) Microsoft ACPI-Compliant System
(ISA) 0x00000067 (103) Microsoft ACPI-Compliant System
(ISA) 0x00000068 (104) Microsoft ACPI-Compliant System
(ISA) 0x00000069 (105) Microsoft ACPI-Compliant System
(ISA) 0x0000006A (106) Microsoft ACPI-Compliant System
(ISA) 0x0000006B (107) Microsoft ACPI-Compliant System
(ISA) 0x0000006C (108) Microsoft ACPI-Compliant System
(ISA) 0x0000006D (109) Microsoft ACPI-Compliant System
(ISA) 0x0000006E (110) Microsoft ACPI-Compliant System
(ISA) 0x0000006F (111) Microsoft ACPI-Compliant System
(ISA) 0x00000070 (112) Microsoft ACPI-Compliant System
(ISA) 0x00000071 (113) Microsoft ACPI-Compliant System


(ISA) 0x00000072 (114) Microsoft ACPI-Compliant System
(ISA) 0x00000073 (115) Microsoft ACPI-Compliant System
(ISA) 0x00000074 (116) Microsoft ACPI-Compliant System
(ISA) 0x00000075 (117) Microsoft ACPI-Compliant System
(ISA) 0x00000076 (118) Microsoft ACPI-Compliant System
(ISA) 0x00000077 (119) Microsoft ACPI-Compliant System
(ISA) 0x00000078 (120) Microsoft ACPI-Compliant System
(ISA) 0x00000079 (121) Microsoft ACPI-Compliant System
(ISA) 0x0000007A (122) Microsoft ACPI-Compliant System
(ISA) 0x0000007B (123) Microsoft ACPI-Compliant System
(ISA) 0x0000007C (124) Microsoft ACPI-Compliant System
(ISA) 0x0000007D (125) Microsoft ACPI-Compliant System
(ISA) 0x0000007E (126) Microsoft ACPI-Compliant System
(ISA) 0x0000007F (127) Microsoft ACPI-Compliant System
(ISA) 0x00000080 (128) Microsoft ACPI-Compliant System
(ISA) 0x00000081 (129) Microsoft ACPI-Compliant System
(ISA) 0x00000082 (130) Microsoft ACPI-Compliant System
(ISA) 0x00000083 (131) Microsoft ACPI-Compliant System
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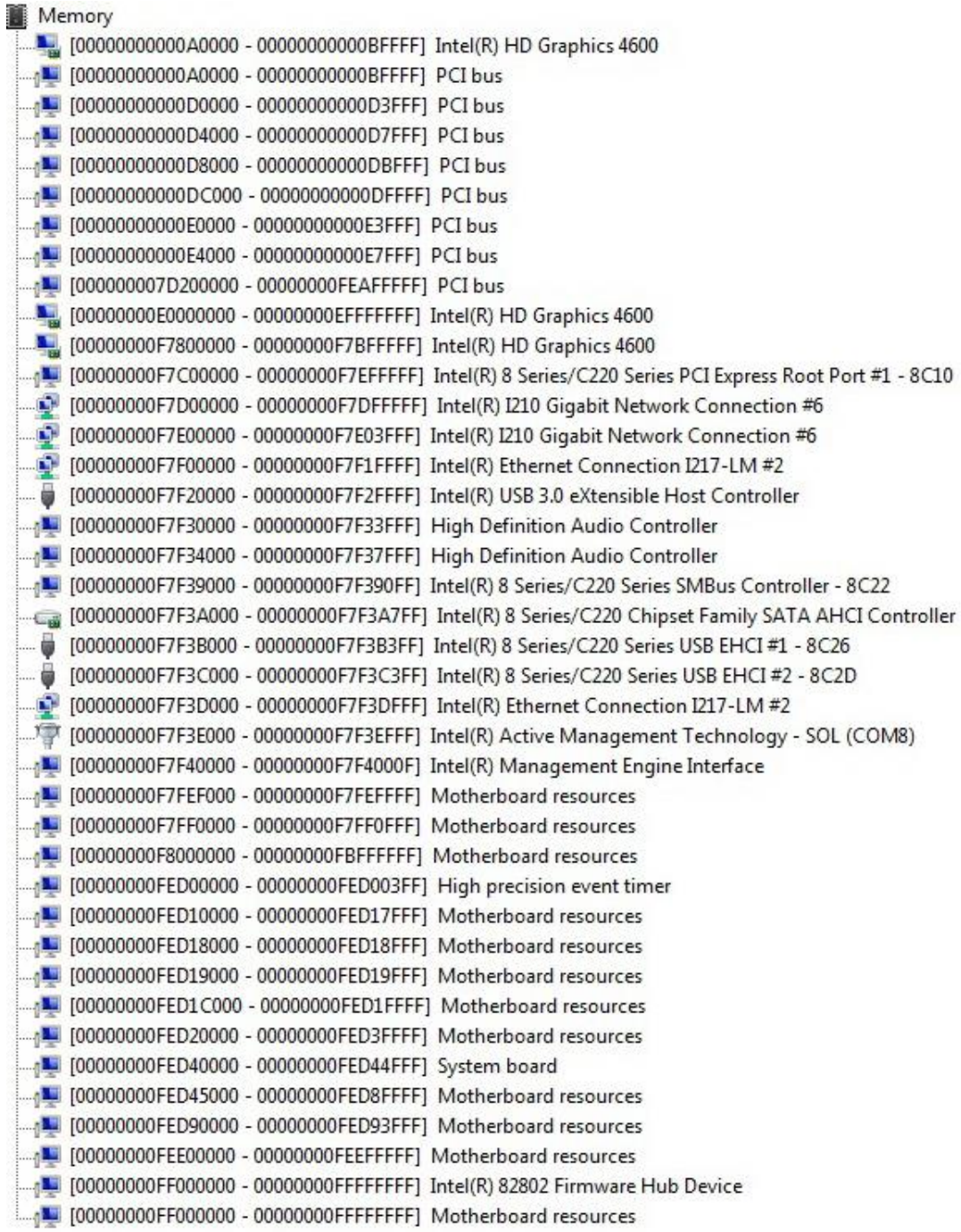
(ISA) 0x00000085 (133) Microsoft ACPI-Compliant System
(ISA) 0x00000086 (134) Microsoft ACPI-Compliant System
(ISA) 0x00000087 (135) Microsoft ACPI-Compliant System
(ISA) 0x00000088 (136) Microsoft ACPI-Compliant System
(ISA) 0x00000089 (137) Microsoft ACPI-Compliant System
(ISA) 0x0000008A (138) Microsoft ACPI-Compliant System
(ISA) 0x0000008B (139) Microsoft ACPI-Compliant System
(ISA) 0x0000008C (140) Microsoft ACPI-Compliant System
(ISA) 0x0000008D (141) Microsoft ACPI-Compliant System
(ISA) 0x0000008E (142) Microsoft ACPI-Compliant System
(ISA) 0x0000008F (143) Microsoft ACPI-Compliant System
(ISA) 0x00000090 (144) Microsoft ACPI-Compliant System
(ISA) 0x00000091 (145) Microsoft ACPI-Compliant System
(ISA) 0x00000092 (146) Microsoft ACPI-Compliant System
(ISA) 0x00000093 (147) Microsoft ACPI-Compliant System
(ISA) 0x00000094 (148) Microsoft ACPI-Compliant System
(ISA) 0x00000095 (149) Microsoft ACPI-Compliant System
(ISA) 0x00000096 (150) Microsoft ACPI-Compliant System
(ISA) 0x00000097 (151) Microsoft ACPI-Compliant System
(ISA) 0x00000098 (152) Microsoft ACPI-Compliant System
(ISA) 0x00000099 (153) Microsoft ACPI-Compliant System
(ISA) 0x0000009A (154) Microsoft ACPI-Compliant System
(ISA) 0x0000009B (155) Microsoft ACPI-Compliant System
(ISA) 0x0000009C (156) Microsoft ACPI-Compliant System
(ISA) 0x0000009D (157) Microsoft ACPI-Compliant System
(ISA) 0x0000009E (158) Microsoft ACPI-Compliant System
(ISA) 0x0000009F (159) Microsoft ACPI-Compliant System
(ISA) 0x000000A0 (160) Microsoft ACPI-Compliant System
(ISA) 0x000000A1 (161) Microsoft ACPI-Compliant System
(ISA) 0x000000A2 (162) Microsoft ACPI-Compliant System
(ISA) 0x000000A3 (163) Microsoft ACPI-Compliant System
(ISA) 0x000000A4 (164) Microsoft ACPI-Compliant System
(ISA) 0x000000A5 (165) Microsoft ACPI-Compliant System

6.3 Memory Map

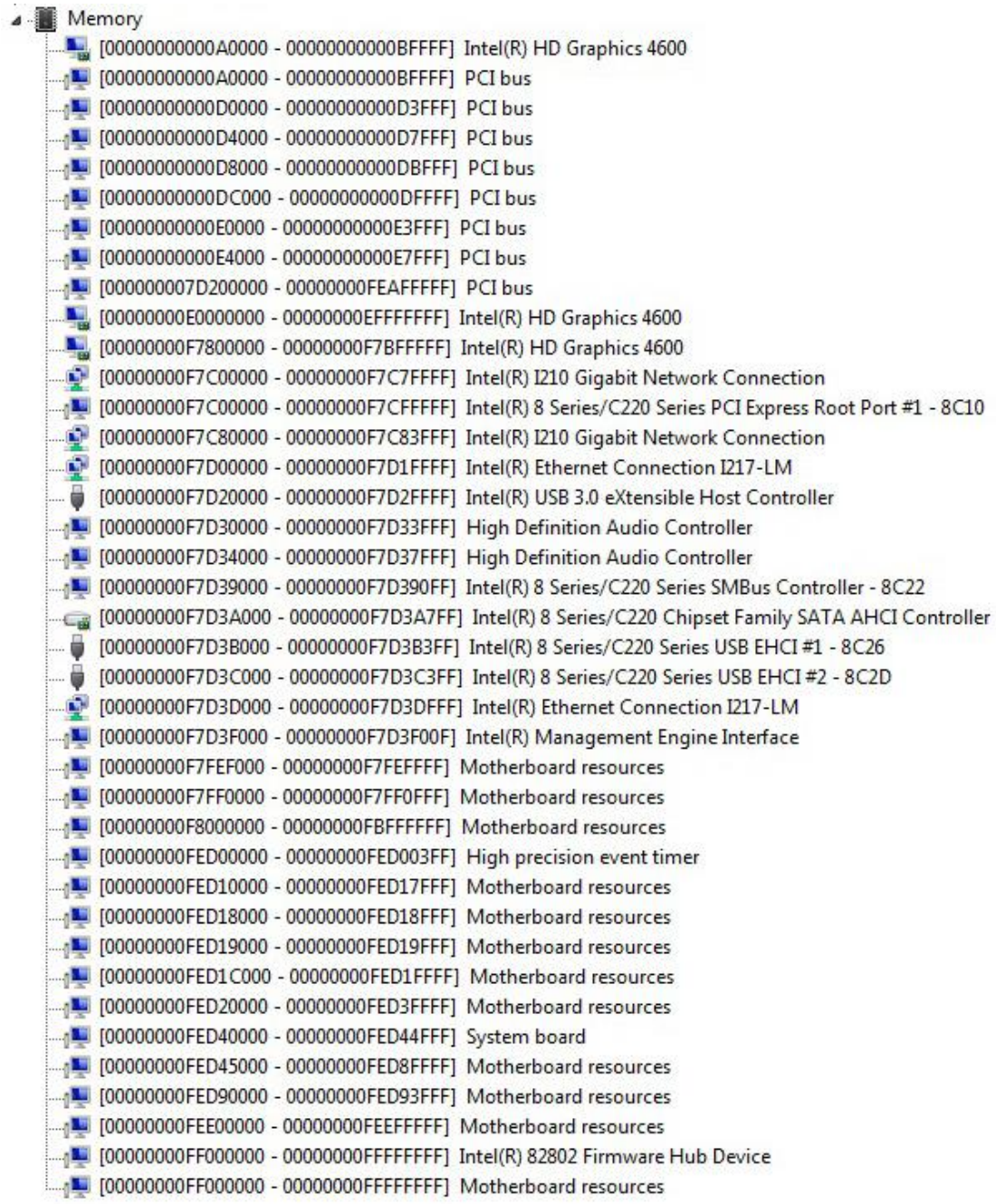
- CT-MHW01

The memory map of DRAM for the CT-MHW01 under Windows® 7 Ultimate/64bit are shown below.


Memory
[00000000000A0000 - 00000000000BFFFF] Intel(R) HD Graphics 4600
[00000000000A0000 - 00000000000BFFFF] PCI bus
[00000000000D0000 - 00000000000D3FFF] PCI bus
[00000000000D4000 - 00000000000D7FFF] PCI bus
[00000000000D8000 - 00000000000DBFFF] PCI bus
[00000000000DC000 - 00000000000DFFFF] PCI bus
[00000000000E0000 - 00000000000E3FFF] PCI bus
[00000000000E4000 - 00000000000E7FFF] PCI bus
[000000007D200000 - 00000000FEAFFFFF] PCI bus
[00000000E0000000 - 00000000EFFFFFFF] Intel(R) HD Graphics 4600
[00000000F7800000 - 00000000F7BFFFFF] Intel(R) HD Graphics 4600
[00000000F7C00000 - 00000000F7EFFFFF] Intel(R) 8 Series/C220 Series PCI Express Root Port #1 - 8C10
[00000000F7D00000 - 00000000F7DFFFFF] Intel(R) I210 Gigabit Network Connection #6
[00000000F7E00000 - 00000000F7E03FFF] Intel(R) I210 Gigabit Network Connection #6
[00000000F7F00000 - 00000000F7F1FFFF] Intel(R) Ethernet Connection I217-LM #2
[00000000F7F20000 - 00000000F7F2FFFF] Intel(R) USB 3.0 eXtensible Host Controller
[00000000F7F30000 - 00000000F7F33FFF] High Definition Audio Controller
[00000000F7F34000 - 00000000F7F37FFF] High Definition Audio Controller
[00000000F7F39000 - 00000000F7F390FF] Intel(R) 8 Series/C220 Series SMBus Controller - 8C22
[00000000F7F3A000 - 00000000F7F3A7FF] Intel(R) 8 Series/C220 Chipset Family SATA AHCI Controller
[00000000F7F3B000 - 00000000F7F3B3FF] Intel(R) 8 Series/C220 Series USB EHCI #1 - 8C26
[00000000F7F3C000 - 00000000F7F3C3FF] Intel(R) 8 Series/C220 Series USB EHCI #2 - 8C2D
[00000000F7F3D000 - 00000000F7F3DFFF] Intel(R) Ethernet Connection I217-LM #2
[00000000F7F3E000 - 00000000F7F3EFFF] Intel(R) Active Management Technology - SOL (COM8)
[00000000F7F40000 - 00000000F7F4000F] Intel(R) Management Engine Interface
[00000000F7FEF000 - 00000000F7FEFFFF] Motherboard resources
[00000000F7FF0000 - 00000000F7FF0FFF] Motherboard resources
[00000000F8000000 - 00000000FBFFFFFF] Motherboard resources
[00000000FED00000 - 00000000FED003FF] High precision event timer
[00000000FED10000 - 00000000FED17FFF] Motherboard resources
[00000000FED18000 - 00000000FED18FFF] Motherboard resources
[00000000FED19000 - 00000000FED19FFF] Motherboard resources
[00000000FED1C000 - 00000000FED1FFFF] Motherboard resources
[00000000FED20000 - 00000000FED3FFFF] Motherboard resources
[00000000FED40000 - 00000000FED44FFF] System board
[00000000FED45000 - 00000000FED8FFFF] Motherboard resources
[00000000FED90000 - 00000000FED93FFF] Motherboard resources
[00000000FEE00000 - 00000000FEEFFFFF] Motherboard resources
[00000000FF000000 - 00000000FFFFFFFF] Intel(R) 82802 Firmware Hub Device
[00000000FF000000 - 00000000FFFFFFFF] Motherboard resources

- CT-MHW02

The memory map of DRAM for the CT-MHW02 under Windows® 7 Ultimate/64bit are shown below.


Memory
[00000000000A0000 - 00000000000BFFFF] Intel(R) HD Graphics 4600
[00000000000A0000 - 00000000000BFFFF] PCI bus
[00000000000D0000 - 00000000000D3FFF] PCI bus
[00000000000D4000 - 00000000000D7FFF] PCI bus
[00000000000D8000 - 00000000000DBFFF] PCI bus
[00000000000DC000 - 00000000000DFFFF] PCI bus
[00000000000E0000 - 00000000000E3FFF] PCI bus
[00000000000E4000 - 00000000000E7FFF] PCI bus
[000000007D200000 - 00000000FEAFFFFF] PCI bus
[00000000E0000000 - 00000000EFFFFFFF] Intel(R) HD Graphics 4600
[00000000F7800000 - 00000000F7BFFFFF] Intel(R) HD Graphics 4600
[00000000F7C00000 - 00000000F7C7FFFF] Intel(R) I210 Gigabit Network Connection
[00000000F7C00000 - 00000000F7CFFFFF] Intel(R) 8 Series/C220 Series PCI Express Root Port #1 - 8C10
[00000000F7C80000 - 00000000F7C83FFF] Intel(R) I210 Gigabit Network Connection
[00000000F7D00000 - 00000000F7D1FFFF] Intel(R) Ethernet Connection I217-LM
[00000000F7D20000 - 00000000F7D2FFFF] Intel(R) USB 3.0 eXtensible Host Controller
[00000000F7D30000 - 00000000F7D33FFF] High Definition Audio Controller
[00000000F7D34000 - 00000000F7D37FFF] High Definition Audio Controller
[00000000F7D39000 - 00000000F7D390FF] Intel(R) 8 Series/C220 Series SMBus Controller - 8C22
[00000000F7D3A000 - 00000000F7D3A7FF] Intel(R) 8 Series/C220 Chipset Family SATA AHCI Controller
[00000000F7D3B000 - 00000000F7D3B3FF] Intel(R) 8 Series/C220 Series USB EHCI #1 - 8C26
[00000000F7D3C000 - 00000000F7D3C3FF] Intel(R) 8 Series/C220 Series USB EHCI #2 - 8C2D
[00000000F7D3D000 - 00000000F7D3DFFF] Intel(R) Ethernet Connection I217-LM
[00000000F7D3F000 - 00000000F7D3F00F] Intel(R) Management Engine Interface
[00000000F7FEF000 - 00000000F7FEFFFF] Motherboard resources
[00000000F7FF0000 - 00000000F7FF0FFF] Motherboard resources
[00000000F8000000 - 00000000FBFFFFFF] Motherboard resources
[00000000FED00000 - 00000000FED003FF] High precision event timer
[00000000FED10000 - 00000000FED17FFF] Motherboard resources
[00000000FED18000 - 00000000FED18FFF] Motherboard resources
[00000000FED19000 - 00000000FED19FFF] Motherboard resources
[00000000FED1C000 - 00000000FED1FFFF] Motherboard resources
[00000000FED20000 - 00000000FED3FFFF] Motherboard resources
[00000000FED40000 - 00000000FED44FFF] System board
[00000000FED45000 - 00000000FED8FFFF] Motherboard resources
[00000000FED90000 - 00000000FED93FFF] Motherboard resources
[00000000FEE00000 - 00000000FEEFFFFF] Motherboard resources
[00000000FF000000 - 00000000FFFFFFFF] Intel(R) 82802 Firmware Hub Device
[00000000FF000000 - 00000000FFFFFFFF] Motherboard resources